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ABSTRACT

This report presents eight papers prepared for a workshop held in June 1980, which was planned to exchange ideas and experiences about, and arrive at a better understanding of, the technological issues that have an impact on videotex systems and their use. Papers emphasize alternative architectures for present and future videotex systems; database structures for supporting simple, user-oriented data retrieval facilities; and the role of information providers. Individual papers presented are (1) "Adaptation of Existing Library Databases to Videotex," by A. J. S. Ball; (2) "Providing Business Information to Prestel," by Brian Botten; (3) "Omnitel TM--An Integrated Broadband Distribution System for the Eighties," by J. J. Coyne; (4) "Database Structures for Videotex Applications," by Jan Gecsei and Gregor V. Bochmann; (5) "Integration of an Alphageometric Information System to a Two Way Coaxial Cable Network," by J. L. Houle; (6) a position paper by D. Leahy on viewdata systems; (7) "Presentation de STAR: (Source Telestel Acces Reseau)" (a minicomputer-based system designed to provide access to a videotex network), by D. Le Moign and (8) "Preliminary Views on Data Base Architectures for Videotex," by Frank Wm. Tompa. A summary of topics discussed, a list of participants, and a bibliography are included. (LMM)

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# FIRST MONTREAL WORKSHOP ON VIDEOTEX TECHNOLOGY*

by

A. Ball, G. V. Bochmann, B. Botten, J. Coyne, J. Geesei, J.-L. Houle, D. Leahy, D. Le Moign and F. Tompa.

Document de travail # 112

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Département d'informatique et de recherche opérationnelle, Université de Montréal, 9 - 18 juin 1980

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## 1. PREFACE

The First Montreal Workshop on Videotex Technology was held at the University of Montreal from June 9 through 18, 1980. This report contains the written contributions of the participants to the discussions at the workshop. It must be understood that these papers were prepared before the workshop, some of them in a hurry, and that the discussions during the workshop had the view of the participants evolved. Therefore these papers do not necessarily represent the present opinion of the authors.

The purpose of the workshop was to exchange ideas and experience about, and arrive at a better understanding of, the technological issues that have an impact on videotex systems and their use. Much attention was given to alternate architectures for present and future videotex systems, database structures (e.g. use of keywords, directories and distribution programs attached to each page), for supporting simple, user-oriented data retrieval facilities and the role of information providers. The discussion centered around the issues listed in section 3.

A list of the participants at the workshop is given in section 2. We regret that representants from some key Canadian organisations directly involved in videotex development did not participate in the workshop.

It is planned that the results of the workshop will be summarized in several papers to be written by the participants.

Gregor V. Bochmann
Jan Gecsei

Wirkshop Organizers

# FIRST MONTREAL WORKSHOP ON VIDEOTEX TECHNOLOGY

June 9-20 1980, University of Montreal

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## Outline of Topics

1. Database structures
   - . Consideration of different DB structures:
     - (a) Simple tree
     - (b) Alternatives, enhancements: pointers, keywords, record-oriented
   - . Adequacy for different applications
   - . Adaptation of existing DB to videotex
   - . User interface, query languages
   - . Efficiency and performance problems
   - . Implementation, e.g. use of DB machines

2. Distribution of videotex data
   - . Data duplication: how much?
   - . Global directories: how to get to the right data?
   - . Relations between different sites (pointers)
   - . Update problems (integrity, update scheduling, propagation)

3. Integrated information services
   - . Home info. services: telephone, TV, music, videotex, alarms, etc.
   - . Role of local videotex center
   - . Friendly user interface, help facilities, standards
   - . Interworking between different videotex systems

4. Advanced services

   . Telesoftware and action pages

   . User-to-user and user-to system messaging, electronic mail

   . Tele-shopping and other transactions

   . Terminals with local intelligence

5. Distributed system architecture

   . Local distribution technologies: phone, cable, opt. fibers, satellite

   . Communication methods and protocols: transmission error recovery for telesoftware, transactions.

6. Distributed videotex system management

   . Local videotex center

   . User identification, login

   . Access anthorization, authority domains

   . Charging and billing

   . Encryption methods

   . Protection against abuse of obtained information (e.g. local storage)

# ADAPTATION OF EXISTING LIBRARY DATABASES TO VIDEOTEX

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## INTRODUCTION

Databases maintained by libraries and/or accessed by library users belong to a multidimensional spectrum. One dimension is archival to ephemeral; another is primary to secondary to tertiary, etc. The contents of such databases range through graphical, numerical, textual and pictorial and one can find examples from most parts of this matrix in machine readable form.

Some examples are a newspaper database; archival in nature with a mixture of primary and secondary data, with the emphasis on new data. A machine readable encyclopedia is also archival and it's data contents are secondary, tertiary or even more steps removed from the original data. A telephone directory is an example of a primary-ephemeral database.

Libraries usually maintain several databases in support of their information storage and retrieval operations. Generally, the data content is secondary rather than primary and consists largely of descriptions of objects which themselves contain data, which in turn may be primary or secondary. The term "library" has archival connotations for most people and one of the libraries files, the catalogue is largely archival in nature although its record contents, and particularly its indexes, do change and in some libraries change rapidly.

Two other files that most libraries maintain are the acquisitions or on-order file and the circulation or inventory control files. The acquisition file is definitely ephemeral.

It is purged and replaced on a regular cycle as books are received, orders cancelled or more exact book descriptions appear. The circulation file is also ephemeral in nature and is a sub-set of the catalogue file. It includes a short description of each book or "informational object" that is checked out, lost, stolen or reserved, linked to the description of the person or location (other than it's home location) to which it has been checked out to, lost by, etc. This generates a fourth and fifth file, the patron name and address file, which is very ephemeral and difficult to update and the black list of bad borrowers, unfortunately not so ephemeral.

Also of interest are a libraries file(s) of ephemera - the current cabinet ministers, city council members, government directories, community organizations, charities and similar social information. These are usually paper-based files although Pikes Peak Regional Library, Colorado, is attempting to put such information into its circulation system computer.

LIBRARY CATALOGUES

Very few library catalogues are 100% machine readable although there are, in Canada and the U.S., very large numbers of libraries who's new catalogue records are computer produced and stored. The size of the files varies enormously as does the data content and the quality of the data. At the top end of the range are multi-library databases - union files - which may contain 3 - 7 million bibliographic descriptions each representing a discrete "book". Each title record will have library and/or branch library location symbols attached. The

OCLC database serves over 2,000 libraries and the UTLAS system in Toronto serves over 500 libraries. The data stored in such national level databases usually conforms to the appropriate MARC standard, eg. the monograph, serial, map or audio/visual standard. Such records are very detailed and attempt to store all possible (useful?) pieces of data that could aid a future searcher in rediscovering the item and its information content. Such records are internally tagged to an agreed international format and may contain literally hundreds of fixed and/or variable fields. Such descriptions are communications formats - designed for serial transmission modes, particularly tapes. The tags are used to aid data capture but the MARC format is largely irrelevant to the internal structure of such large on-line databases. MARC tells you what data elements you might find, but not how to store them.

At the other end of the spectrum are simple Author, Title, Subject catalogues which provide minimal book descriptions most often in fixed field records and not necessarily on-line. Very small catalogues might have 1 - 2,000 records although a library with 50,000 titles is small by U.S. standards. One other point is that in many libraries, and particularly public libraries, there are multiple copies. For example, a public library with 100,000 titles may in fact have 300,000 books on its shelves. In a circulation system database not only is the title record stored, usually Author, Title and Imprint, but also a unique number identifying each physical item and a code to represent it's location.

There is also a strong trend to utilize database technology in on-line library catalogues. That is, one book description will serve both the catalogue function and the inventory control or circulation function. Currently, attempts are being made to integrate acquisitions functions into such on-line in-house computers. From a users viewpoint this trend is excellent. From a videotex standpoint the prospect is also good. Most of the installed systems are standalone, turn-key, and there are only 4 or 5 successful vendors in the Canada - U.S. market. This puts a limit on the number of interfaces that have to be developed.

USE OF LIBRARY FILES

The following is necessarily general in nature and is based on the libraries in Saskatchewan. The hierarchical nature of the catalogues and the ways in which these are used to locate sources of information, books for short, is typical of library praxis although the geographical units and degree of integration may differ quite markedly in other jurisdictions.

If a person decides to "try the library" when looking for information, he or she will usually walk into a branch library which is part of a larger system. At the branch she may have access only to a branch catalogue. If the library system is fully automated then the patron will usually have access to a union catalogue for the whole system. This may be on microfiche, microfilm or on-line. At this time there are only a few libraries that can offer on-line inquiry through Author, Title and Subject indexes. Generally speaking, the search

made at a local level, is done unaided or with minimal intervention by library staff, see Figure 1.

If the patron fails to find a source then the librarian intervenes. If the patron is looking for a particular item and has a bibliographic description, the first step is to validate that description. This is usually done by searching for the item in the catalogue of a larger collection, eg. the Library of Congress Catalogue, Canadiana, the national bibliography or a publisher database like Books in Print. If the books' identity can be established a second search will be done to find a location in a geographically proximate library. In Saskatchewan, the request would go to the Provincial Library. Staff at this library would search the Saskatchewan Union Catalogue. If a location was not found, the request would be referred to the National Library and potentially to other national libraries until either the request was fulfilled or the system broke down (loan requests usually have a cut-off date attached).

In Canada the local, provincial and national libraries will also accept subject searches. These too can be referred up the hierarchy of increasing bibliographic resources. Library workers will use other secondary resources, Abstracts, Bibliographies, Printed Catalogues, Indexes, etc. to discover a source description before launching a search for a location. In an increasing number of cases these searches will be computer assisted using pay-as-you-go services such as SDC's ORBIT or Lockheed's DIALOG service. These systems allow computer

assisted searching of a large range of primary and secondary data files. Such files represent virtual catalogues in that they do not describe actual collections of items but rather collections of information on particular subjects. At the present time the structures of such systems (ORBIT, DIALOG, BRS etc.) and their query languages are quite complex so that most such searches are librarian mediated. This paper will not address itself to interfaces between such bibliographic utilities and videotex services.

In summary, a patron wants to extract answers to the following questions from the libraries files.

(a) source questions:

(i) Do you have book "x"?

(ii) Do you have any books by "y"?

(iii) Do you have any books on "z"?

Reference questions in colleges and universities biase towards (i) and (ii); in public libraries towards (ii) and (iii).

(b) availability questions:

(i) Is it on the shelf?

(ii) Is it out?

(iii) Can you get it for me?

(iv) Can you give me a substitute?

For the patron some of these questions, particularly a(iii) and b(iii) lead to library collections beyond the local one. For the present, intervention and mediation by library staff is mandatory. This is a function of negotiated inter-library

loan protocals which in turn result from current technology which is mail and teletype based.

For questions like b(i) and (ii) the patron needs access to the libraries circulation files (read only) and for questions like b(iii) the patron may need access to transaction commands (read and write) to post reservations or leave messages for library staff via the circulation system.

ADAPTATION STRATEGIES

New technology can be theoretically applied at two extremes (a) to mimic or mechanize existing processes (b) to replace existing processes and achieve the same ends by entirely new means. For library databases there are a number of barriers to solution (b), the largest of which are inertia and complexity. These are largely separate from the technical problems of computers, terminals, database structures etc.

Inertia: there is an existing system and different parts are automating at different rates. The protocols which govern inter-library cooperation have been negotiated over a long period of time by politically and fiscally autonomous bodies. Any attempt to adapt automated library files to videotex must take this into account. Secondly, the data files are structured to serve the needs of particular libraries and particular library functions. It is probably safe to assert that these will not be optimal videotex structures. Also, the search strategies and indexing facilities available in automated libraries depend on text matching via indexes rather than

through menu assisted hierarchical techniques. (Although it is clear that the underlying technology, both in machine and card catalogues relies on inverted indexes.)

Complexity has two forms, one is closely related to the previous paragraph in that the query languages and man-machine interfaces available in current systems are tailored to library staff who are specially trained to use such systems. Generally speaking they are adequate but leave much to be desired for a user-friendly interface. The second form is in the nature of library data. Bibliographic data is not simple and the subject indexing of a collection is an intellectually demanding task. Most library subject indexes use standard terms, subject headings, which are usually taken from some authoritative source; a thesaurus or accepted list of headings. Such entries are under authority control. Such subject systems impose a syndetic structure on the data files in the form of cross-references: see; see also; see from; see also from; broader term; narrower term, depending on the indexing system. These are by no means perfect systems, but it has become a cliché in the library world that for the last decade or so computer freaks have been busy re-inventing (library) wheels rather than progressing beyond these valuable yet imperfect systems.

The last point is that answers to questions like b(i) - (iv) can only be answered through catalogues that are linked to local circulation/on-line catalogue systems. Most of the large bibliographic utilities, like OCLC, WLN and UTLAS have

adopted a distributed database approach to library data and will make no attempt to store circulation-type data in central databases.

My conclusion then, is that the videotex user should be interfaced to the local library files in the first instance and that switching of inquiries upwards or outwards from the local library should be under the control of library staff. Clearly this will not be the final configuration but it is the one which I believe will be most practicable in the near future. Some possible configurations are outlined in Figures 2 and 3.

SOME CONFIGURATIONS

Figure 2 (a) shows a very simple, yet in the long run expensive solution. This is the configuration that will be used by the OCLC Channel 2000 project. The videotex database is created from tapes supplied by the local library in a videotex compatible structure. The library's data in turn is derived from the OCLC machine readable union catalogue via update tapes. This strategy was adopted because the library's computer couldn't support the videotex system and the OCLC database doesn't contain local information of the kind needed by the patron-circ. system interface.

Figure 2 (b) shows a configuration which is under consideration for a University of Waterloo project. The library computer is a GRAC 8000 which already runs a menu oriented, read only, Community Access Package and has spare capacity. The videotex computer will be a PDP/11 owned by the computer

centre (probably). This project is not funded at the moment but negotiations for funds are ongoing.

In any practical application of videotex one can expect the terminal load on the videotex system to be very large compared to the rated capacity of current library systems (under 100). At all times the in-house terminals, particularly the check-in/check-out terminals will have to have priority. Any videotex interface must allow rapid access by external patrons (5 - 7 sec response time max.) without degrading check-out functions beyond 1 - 2 sec response time.

Figure 3 (a) and 3 (b) show two possible configurations for off loading the libraries in-house computer. These are not particularly novel solutions. The common themes are (a) that the data files of the library remain undisturbed in the library's database; (b) videotex inquiry functions are handled by front end CPU(s); (c) alternate indexes are constructed to serve novice searchers (menu based); (d) transaction functions, loan, reserve, message, are handled by the library system; (e) there is a verbal connection between the videotex user and the library staff. Apart from a desire to minimize complexity, there is no reason why solutions embodying all aspects of 3 (a) and (b) might not be constructed.

There are, of course, many technical problems to be overcome, not the least of which are index generation, database update and database security. However, if we assume that present techniques can overcome such difficulties we can sketch a potential terminal session on a Figure 3 style videotex system.

A. Switch on TV/Videotex terminal, indicate to host system a desire for Library Search (rather than New Books; Good Books or Topical Books with reside on the host as bibliographic reviews)

B. Library Search menu displays:

1. Numeric Key Pad Menus
2. Alphabetic Searches
3. Help/Explanation
4. Return to previous frame

C. Person does search until the single bibliographic item level is reached:

1. Check out
2. Place hold
3. Leave message for librarian
4. Next title (+1 or -1)
5. Same author, other books (+1 or -1)
6. Same subject, other books (+1 or -1)
7. Return

If the person chooses "1" the front end will switch to the libraries check-out function and sign that book out, possibly for mail or shuttle delivery.

If the person chooses "2" the library CPU's hold function will take over.

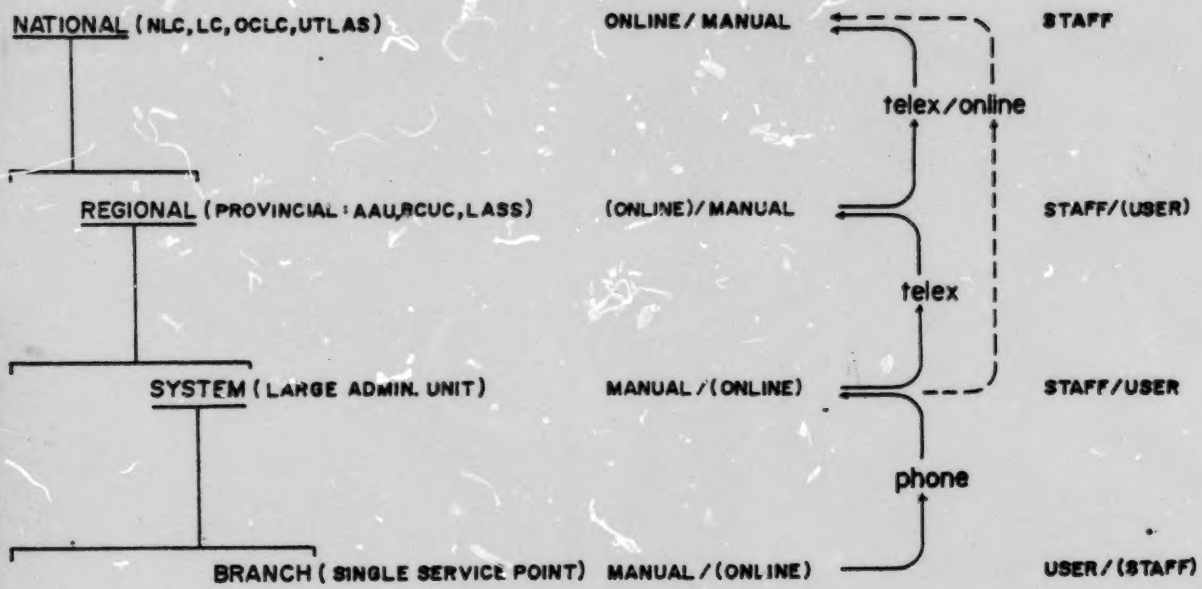
If the person chooses "3" he or she will be provided with a menu of messages or a free-text space so that staff can call back on the telephone and provide reference assistance. Many patron searches are unsuccessful for technical reasons.

If the person chooses 4, 5 or 6 the system will allow the user to browse the data file either in Author, Title or Subject alphabetic order in either direction.

The videotex system should allow the librarian to post messages to the patron such as "I have found a book for you called "_____", do you want an inter-library loan made?" or for the library system to automatically post messages in the users mailbox such as "Your reserved book is now waiting at Glen Elm Branch" or "You have 16 books overdue at a cost of $500.00. Your Library Search and Borrowing privileges have been suspended. Please contact Fred at 569-7582."

So far, very little practical progress has been made with videotex-library interfaces. The Waterloo University project is still nascent, the OCLC project is ongoing, but still in the specification stage and the Lexington Public Library project is barely off the ground. However, a number of librarians, particularly those with machine readable databases, are looking to videotex systems as a way of rejuvinating library services. Others, more Jeremia-like will embrace videotex technology to prevent the library's valuable resources from being by-passed by the cultural mainstream.

FIG. 1: INTER LIBRARY LOAN TRAFFIC PATTERNS



# VIDEOTEX - LIBRARY SYSTEMS

FIG. 2(a): CHANNEL 2000 / OCLC Inc.

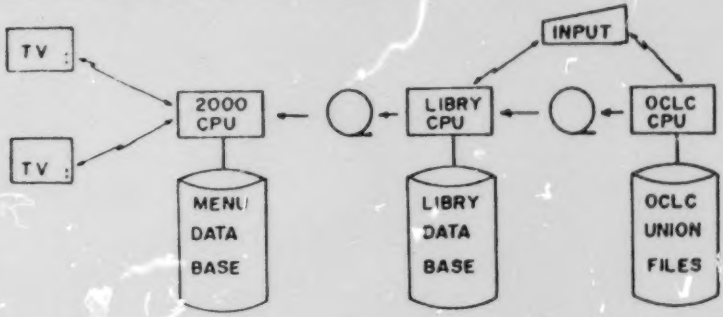



FIG. 2(a): UNIV. WATERLOO / GEAC

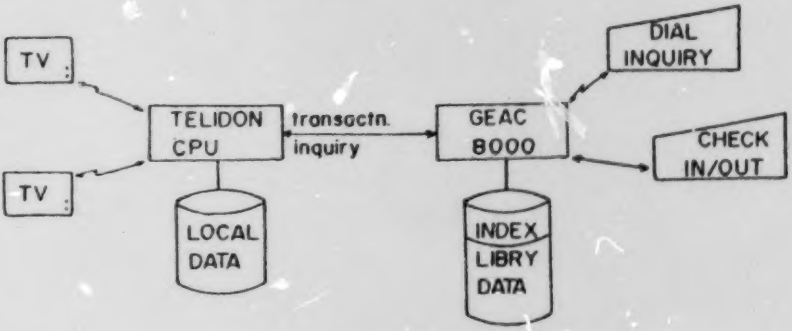


FIG. 3(a): SHARED DATABASE

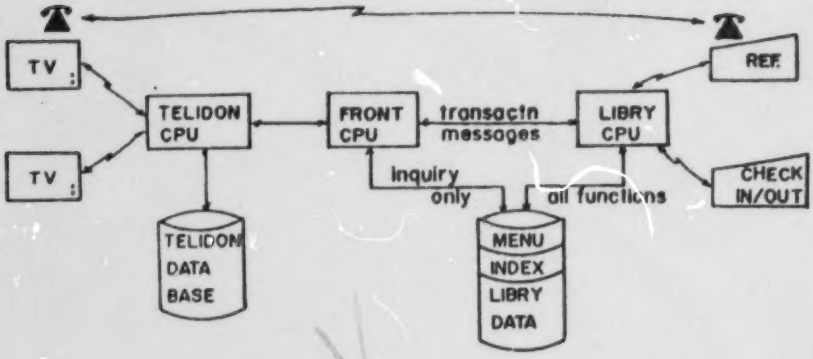
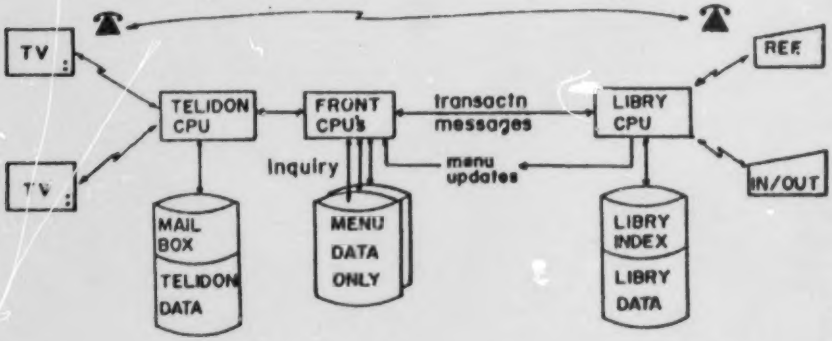



FIG. 3(b): SEPARATE INDEXES



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A.J.B. Ball

May 1980

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# Providing Business Information to Prestel

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First in the field to provide business information on Prestel, Fintel has explored and exploited the opportunities which a newly emerging viewdata industry has presented. Whilst the main thrust of the company's activities has been centred upon viewdata/videotex systems, the long term aim to be a data-base producer with outlets through other on-line access systems will not be ignored. Simply, the business of providing information; being an electronic publisher; requires a flexibility of approach to the supply of information and services to a market place which is surrounded by, and indeed often bemused by, the rapid advances in communications technology over a world-wide front.

## Background

Perhaps the safest thing to say about providing business information to Prestel/viewdata is that it is a business, but not the sole preserve of those companies labelled as "business IPs", though Fintel is one such company.

With the commitment made in 1977 by its two parent companies, The Financial Times and Extel, Fintel was formed in January 1978 to exploit the electronic publishing market which was clearly going to grow through the '80s and beyond. Fintel's basis for growth was not only to seek ways of distributing business information products electronically, but to market its products and services internationally.

In early 1978 it seemed unlikely that the viewdata experiment in the UK would permit the positioning of the company, both at home and abroad, to be achieved so soon. The phenomenom of a videotex industry seemed remote, though inevitable. Yet the evidence two years later, as witnessed by the events at this conference, clearly indicates that videotex systems, videotex services and in particular Prestel, are here to stay.

In common with any newly emerging industry the positioning and strategy of the principal actors are all important. How long those actors can remain on stage depends on flexibility of attitude and, needless to say, financial support. Everyone is aware of the commercial frailty (some would say suicide) of being a pioneer or market leader. Nonetheless, without the drive, without the risk taking, without the self-belief and marketing thrust, nothing happens. Within that framework Fintel's attitude to what its business is, although not fundamentally changed in the long term has undergone a radical shift in emphasis. This is partly because the nature of the industry has demanded it; partly because the mix of staff and the working environment have allowed that flexibility; but principally because we have to be a commercial success. Operationally the company is a "people business". The distribution of costs shown in Tables I and II (attached) clearly shows the emphasis. But within the next two years the relatively large negative cash-flow must show strong evidence of turning positive.

## Fintel Objectives

Clearly our prime objective is to exploit the wealth of information contained, so to speak, in the parental vaults. Extel and F.T. have for long serviced the business community with information and data through a variety of

media, though principally in the printed form.

As with most publishers, the first foray into electronic publishing tended to be a repackaging of existing material. It is extremely difficult not to think in these terms. After all, most information services follow a pattern of repackaging and selling the same information in different forms. Our approach to viewdata was no different, and indeed much of what we do now is still along these lines.

The trick is to supply the value-added content, to place before the user or subscriber information upon which he can act within his decision making process. It has long been said that data is simply data. It only becomes information after the massaging, formatting and authoritative and explanatory comment have been applied.

Fintel's concern therefore in the context of Prestel, is to determine whether or not the viewdata medium is suitable for business information products. As important, if not more so, is the question whether we can find the right type of product which the user will buy, since the product we have to offer is the information and not the vehicle per se.

The Market Trial

From the outset our aim was to set up a discernible test rig for the market place; create an identity for the company; not be too dogmatic as to any particular market sector, e.g. the broking community. In fact, the object was quite the reverse, to examine whether there is a wider need for information in the general business sector. Initially we took information which was easily to hand and which had previously been marketed or proposed as a service. The test data-base was constructed of company news, statistics, comment and abstracts making around 4000 frames which could be viewed as coherent but not necessarily complete. This, based upon around 150 major UK companies, still forms the core upon which other products evolved.

Secondly, the mere fact of being first, the largest, and maintaining an editorial team with "construction expertise" played an important role in establishing credibility as a potential "umbrella" IP i.e. acting as a third party contract house. Further, from a marketing standpoint it allowed the opening up of other avenues into the business market. We found it not sufficient simply to trade upon the F.T. or Extel name. Fintel had to be seen as both different and competent.

This approach has a double-edged effect. The immediate benefit of having a ready made base of subscribers to F.T. and Extel services, such as newsletters or Extel Company Cards, meant that the placing of trial Prestel sets was relatively straightforward. Major corporate clients showed sufficient interest in Prestel on the basis of an invitation by letter. Based on follow-up seminars and interviews concerning the use of Fintel material, the picture then looked somewhat different although not discouraging. The level of expectation of that type of user is naturally high. Corporate librarians are used to receiving or accessing large amounts of information, whether compiled directly or gathered indirectly through services supplied by Extel and F.T., through full on-line access to data-bases like PREDICASTS or the New York Times INFORMATION BANK and many others.

What has emerged is:-

(i) A recognition that the potential of viewdata technology is great, and that information content as well as search facilities will improve.

(ii) Very little comment as to pricing level or strategy, leading one to believe that a "pay as you go" service is acceptable, and that quality information can attract relatively high rates e.g. 15p a frame or more.

(iii) Criticism that there is not enough information and, importantly, it is difficult for the user to know in advance whether his search is likely to be mat

Allied to this is the concept of comprehensive coverage. If, for example, the data-base covers 500 or 1000 companies this is never enough for the professional searcher.

(iv) A discovery that the distinction, say, between Fintel or dataStream or the Stock Exchange is not really apparent to the user: that is to say, many users regard business information as an integrated whole, and will search from one to another.

(v) A discovery that Prestel as a news medium seems relatively popular despite competition from Teletext services as well as conventional broadcast media. In an office environment, with perhaps the exception of Budget Day, radio and TV are seldom used. The need to "look in" to see whats going on, or to

reaffirm a news item, can be satisfied by Prestel.

Lessons Learned So Far

Although it is still too early to be dogmatic, some patterns are developing, and changes of emphasis will be tried.

(i) A more concerted effort will be made to run a Prestel news-wire of events that affect business.

(ii) A universal data-base containing abstracts on all companies over many years is relatively little used (this could change with off-line print capability). Our intention now is to create this universal data-base elsewhere on another on-line vehicle.

(iii) Cross referencing between IP's is being activated to encourage the user in his searching, and to play upon the concept of a "related whole".

A group of business IP's are now arranging with the Post Office to introduce a new level of indexing, probably by industrial sectors, which the Prestel team will maintain with co-operation from IP's.

(iv) To expand a data-base to any size, automatic bulk updating must be used, particularly where frequency of updating is not critical. Fintel's next move will be to examine reformatting and transfer of the Extel EXSTAT data-base (covering approx. 1250 companies including o'seas companies) using the Langton package. Distribution is aimed at Prestel (UK), Prestel International, and overseas videotex services. Importantly, this will be a much more cost effective way of increasing coverage. Simply employing more editors would be extremely uneconomic.

(v) With less than 2000 users the number of frame accesses is around 50-60,000 per month. Expanding to around 50,000 users at the same rate should produce a viable business. The problem is knowing whether this rate will be sustained.

Revenue In Advance

Since revenue from Prestel itself has so far been low, it has become imperative to supplement it to sustain evidence of growth. Broadly this falls into two areas:-

1. The umbrella concept, with variations.

2. Seminars.

The umbrella approach allows the IP to exploit his expertise by offering design and keying facilities to third parties who wish to come onto Prestel as a sub-IP.

Fintel's activities under this generic heading are:-

- Contract services
- Sponsored material
- Corporate advertising

By marketing directly to companies to supply information e.g. Bank Leumi (sponsored material on Israel), outside contractors such as brokers, contract work for American Express, Fintel has grown "umbrella revenue".

Contract work in one form or another means that the IP is not dependent upon user growth. The drawback, however, is that of not achieving a regularly repeatable revenue base. As the sub-IP grows he may wish to take over the work himself.

An important bi-product of dealing with large companies is international exposure and the probability of being the contract agent for overseas systems e.g. Dutch PTT, Bildschirmtext etc. In fact it is now a Fintel policy to have a presence on overseas systems as they emerge. Maintaining a lead position even in a trial status attracts potential business for sale of UK based information delivered in the same (or near compatible) format. The Telset system in Finland now carries Fintel data.

During the next two years, with Prestel usage still low, the emphasis will be on contract work. The marketing and promotional expenses are going to steadily increase to maintain the face of the company in all its guises. Although there may be overt co-operation between business IPs the requirement to keep the company identity in the forefront as a data-base supplier or contract house is vital.

The problem of being buried in the Electronic Bookstall requires a continuous marketing push to achieve visible exposure. One of the critical problems of electronic publishing is that unless you cajole potential users to look at the data-base no one knows it is there. The costs of undoing the blindfold will continue to increase.

## On-line Access Window

Recognising that Prestel systems in themselves will never provide all possible information, Fintel is experimenting as an information broker through on-line access. Requests for searches and delivery of results will be done through the Prestel network. This gives an added plus to the armoury of information sources available, encouraging use of the system and allaying the accusation that content is too shallow.

The so-called "gateway principle" to be adopted by the Germans and French offers a fascinating way of overcoming this problem. But there, apart from routeing indexes, the information will not be visible to the searcher. Prestel at least offers a visible and useful content to the searcher. Also most requests are unlikely to come from the sophisticated searcher. To encourage usage, the system must be simple. The potential population of videotex users is going to be several hundred times larger than the "on-line user" population, but all in time are going to expect to reach more information in depth. Fintel's aim is to make the videotex user aware of the facilities which data-base producers offer.

## The Future

As was mentioned, the flexibility required of the IP is paramount in the first years. No hard and fast rules are possible until:-

(i) A known population of users exists

(ii) Their expenditure rates, search patterns, particular requirements are better known.

(iii) Terminal supplies are assured and reliability of system and user equipment is good.

Fintel has placed little reliance on any particular rate of progress being achieved by the system operator and terminal equipment suppliers. Forecasting has proved to be a dangerous game. However, it is essential that the above factors are better understood; that a service exists; and that the Post Office continues to invest, creating the mechanism for a service, otherwise the users won't come.

It is paramount that the marketing efforts of the IP, much of which has been educational, is supported by the other two principal agencies. Potential user interest in business is high. Crises of confidence reflect badly all round. The potential user is becoming more discerning. Revenue from advertising, sponsorship etc. is vital for

the IPs, and will reduce the cost to the user. It is not sufficient to say that the business user will always pay up. His respect has to be earned.

The present economic uncertainty of the '80s will not help the selling of information services, even though they may be pre-requisites for good management. There is, however, a sustained belief that:-

a) information will be distributed and retrieved electronically

b) the management of information will be the key to success in running a business

The information revolution of the '80s, it is suggested, will rank in importance with the industrial revolution which went before. Above all, it is a communications revolution. The vested interests of the communications authorities and computer hardware manufacturers are enormous. They will want to encourage information. The heart of their activities, in revenue terms, is the business sector. The aim of the business IP, therefore, is to recognise these forces and be prepared to influence and participate in developments and capture their share of a multi-billion dollar industry.

TABLE I - BREAKDOWN OF COMPANY COSTS

| EXPENSE ITEM | % TOTAL COSTS |
|---|---|
| 1. Manpower | 41 |
| 2. Communications + Prestel Charges | 12 |
| 3. R&D + Consultancy | 11 |
| 4. Office Space + General O'hds. | 23 |
| 5. Promotional | 7 |
| 6. Other | 6 |

NOTE: Approx. 80% of all costs are attributable to Prestel/viewdata activities.

TABLE II - BREAKDOWN OF STAFF & SALARY/COSTS

1980 level - 15 staff with provision for 2 additional editors

| | FUNCTION | NUMBERS | % SALARIES |
|---|---|---|---|
| 1. | Management + Secretarial | 3 | 23 |
| 2. | Editorial | 5+(2) | 28 |
| 3. | Marketing + New Contract Work | 4 | 31 |
| 4. | Research & Development + Programming | 3 | 18 |

NOTE: There is at least a 50% contribution to editorial design and keyboard activities provided under item 3.

# OMNITEL ™ - AN INTEGRATED BROADBAND DISTRIBUTION SYSTEM FOR THE EIGHTIES

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INTRODUCTION

During the last decade many segments of society have expressed an active interest in the possibility of developing advanced telecommunication and computer services. These services, sometimes called Télématique services - have been directed at the residential, as well as the business market place. (1-5) This interest has manifested itself in the funding of many paper studies, as well as a considerable number of service and technology trials throughout the world. Canada is one of leaders in this process. Actual marketing of advanced services has already been started in a limited way by some cable television and telephone companies in the United States and Canada. In most cases the distribution technology used is based on coax cable or copper pairs, due to their near to medium term cost effectiveness. More recently, however, field testing of fiber optic technology has begun, with a target of economic provein by the mid to late eighties in the distribution part of the network. (6-7)

Thus what we see happening, in the telecommunications industry, and in society as a whole, is a heightened awareness of what is possible, and a willingness to experiment with new services and new technological approaches. We even see some evidence that there is a definite and potentially large market for some of these new services in the residential segment, as long as they can be offered at a low price, in a form that is satisfying to the consumer. It is also apparent that the continued impetus of the information explosion and the energy crisis will only serve to considerably enhance the realizable market for these new "télématique" services, particularily in the residential market.

In all of this, there are a myriad of important questions to consider, ranging from those that stem from regulatory considerations, to the key techno-economic question, i.e. how can an operating company (telephone or cable television company alike) build a local distribution network for télématique services such that each service incorporates all the important features required to meet subscriber demand, and yet is economically sustainable at a tariff, for each service, that is within reach of the typical consumer.

This is the crux of the challenge that is before us at this time...

This paper primarily addresses the latter question by outlining a systems approach to implementing integrated broadband distribution networks that will be cost effective in the near term - but is sufficiently flexible and open ended that is is likely to remain viable in an operational sense at least until the year 2000. This approach is being implemented for the first time in a coax cable based system called Omnitel TM II and is the basis of Manitoba Telephone's Project IDA. Other versions of the same system approach are planned for implementation on fiber optics (Omnitel TM III) and - with reduced capabilities - on copper pairs (Omnitel TM I). This paper will focus on the Omnitel TM II system - because that is the version that holds the most promise for being cost effective in urban areas and high density rural areas in the near term. Omnitel TM I (with its reduced capabilites) is only expected to be cost effective for use in low density rural areas. Both Omnitel TM I and Omnitel TM II are expected to be surpassed by Omnitel TM III for new installations in both urban and rural areas by the late eighties, although they are nonetheless expected to remain operationally viable until after the year 2000.

## SERVICE OBJECTIVES

Figure 1 summarizes the desired service capabilities of an integrated multiservice broadband distribution system,which are in turn embodied in Omnitel TM. Note that Omnitel TM II and Omnitel TM III have identical service capability, while Omnitel TM I is out of necessity limited to narrowband services only. In addition, although it may not be immediately obvious, there are even some important narrowband subscriber services and features that are not available using Omnitel TM I because of the bandwidth limits of the copper paired media.

## SYSTEM DESIGN FEATURES

A multiuse distribution network must incorporate a number of important system design features to minimize the overall operating cost under the widest possible range of conditions. A summary of the most important features that should be incorporated in an integrated broadband distribution network is as follows:

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Omnitel TM II is a Trade Mark of Interdiscom Systems Ltd.

- Subscriber additions, deletions, and moves should be possible at minimum cost with no service disruption.

- Flexibility in the choice of offered services should be allowed, without cost penalty to the subscriber.

- Security (or privacy) of telephone, data and some video services should be maintained at a level equal to or better than currently provided by individual line telephone service.

- Shared viewing of certain other video services under central computer control should also be provided. This will reduce the usage cost for such services as Pay TV, Narrowcasting and Video Program Retrieval from a library.

- Video transmission is to be compatible with the current 525 Line NTSC analog Video standard in North America, or equivalent elsewhere in the world.

- Compatibility is to be provided with existing analog and future digital switching equipment.

- An effective interface should be provided to existing or proposed Local Broadband Networks in nearby small towns or cities.

- The system design should allow evolutionary growth from a minimum service level to the maximum possible set of services that have potential long term economic viability.

NETWORK ARCHITECTURE

The implementation of an integrated multiservice broadband distribution network requires the acceptance of a network architecture that is analogous to the central office plan of the telephone network, or the signal processing "hubs" that many of the more progressive cable television companies have already implemented. This network discipline is necessary to allow cost effective network management and control, as well as facilities for curcuit switching for those services requiring it. Omnitel™ II is based on this "hiearchial network discipline".

BASIC PRINCIPLES OF OPERATION

The system comprises a coaxial cable distribution system and four types of active terminals, as illustrated in figure 2. The terminals are a distribution control terminal (DCT) at the Central Office, or Signal Processing Hub, a subscriber terminal unit (STU) on the subscriber's premises, and two field mounted units - the intermediate distribution terminal (IDT) and the remote video and data multiplexer (RVDM). In addition, a mini-computer at a central computing complex (CCC) is used to provide centralized maintenance and network control.

All data and telephony traffic is handled by two DS-1 (1.544 Mbps) bit streams per DCT, which are in turn modulated up in frequency and multiplexed with all the video signals in the VHF Analog Multiplex bay.

The role of the DCT is to supervise two DS-1 bit streams (1.544 Mbps each) which are used to provide digital telephony to some 300 subscribers; to provide high and low speed data to subscribers, and to monitor the IDT's to which the DCT is connected for any malfunction. At the Central Office or Signal Processing Hub all the video signals needed to serve the subscribers are also inserted into the coaxial cable. These include ordinary CATV, Pay TV and channels for visual library and narrowcasting services.

The IDT acts as an upstream noise filter, performing frequency conversion and regeneration of the modulated digital signals. It also controls and supervises the RVDM's under it. In systems not carrying much telephony, several IDT's may share the same DS-1 streams, so time slot interleaving will be a requirement.

The RVDM is one of the most active units in the system. It has an analogue portion and a digital portion. The digital portion combines the role of controller and data multiplexer. A separate 1.544 Mbps stream between each subscriber and the RVDM enters and leaves the digital sections, and the necessary control information is inserted and extracted from that stream in order to allow the controller to provide the subscriber with the service he requires. Data and digital telephony messages pass between subscriber and RVDM on time slots allocated by the controller, with each subscriber re-

ceiving only the data or telephony signals intended for him. Analogue video signals are frequency switched under instructions from the controller, again with each subscriber receiving only the signals intended for him. The RVDM also includes the packet controller and videotex display generators which are assigned on demand to provide low cost videotex service. Finally, the RVDM constantly scans the set of input ports, each one of which is associated with an individual STU, acting on any control messages received.

The STU is controlled by a single chip microprocessor. It polls a range of devices, such as alarm detectors, keypads for video service and utility meters. It also accepts digital information from keyboards, and keypad over a data bus and performs the necessary D/A and A/D conversion as well as 2/4 wire interfacing needed between a 500 type telephone set and DS-1 carrier. It constantly transmits a control message to the RVDM, usually an idle message, but replacing that by real control information where required.

Transmission between the DCT and IDT's is over repeatered coaxial cable, acting in a bidirectional mode as illustrated in Figure 3. Downstream (DCT to IDT) transmission is in the band 50 to 300 MHz, while upstream transmission is on 4,6 MHz channels between 5 and 30 MHz. This arrangement does not allow any upstream video transmission. Should this service be required later, either a mid band split must be used, thereby reducing the downstream video capacity, or a new cable must be installed. The action to be taken would depend on expected traffic and revenues.

Transmission between IDT's and RVDM's is over non-repeatered lines, with a frequency plan as illustrated in Figure 4. Downstream video is on the same channels as on the DCT to IDT cable, but telephony uses carriers which are multiples of 1.544 MHz, one near 12 MHz for downstream (IDT to RVDM) transmission, one near 6 MHz for upstream.

Transmission between RVDM and STU is over non-repeatered drops as illustrated in Figure 5, with 1.544 Mbps information on 6 and 12 MHz carriers as before. However, only 2 or 3 video channels are simultaneously transmitted using non-adjacent channels between channels 2 and 6.

Finally, it should be noted that IDT's and RVDM's are tapped onto the cable - i.e. they do not interrupt the flow of singals on a cable, and hence failure of one unit will not cause a loss of signals to any subscribers other than those served directly by that unit.

The current version of the computer control center (CCC) is implemented on an IBM Series 1 minicomputer equipped with 256 Kbytes of memory, 512 Kbytes of Floppy Disc Storage, and a 64 Mbyte Disc Drive. In the longer term a multiprocessor structure will be developed based on off-the-shelf minicomputers or the new generation of 16 bit microprocessor. The software organization of the CCC is illustrated in Figure 6..

There are 4 major software components of the CCC which are in turn broken down into a number of subsystems as follows:

- Communication System (CS)
  - Man-machine Communication Subsytem (MCS)
  - Network Communication Subsystem (NCS)
  - Computer Communication Subsystem (CCS)
  - Application Interface Subsystem (AIS)
  - Videotext Interface Subsystem VIS)
  - File Management Subsystem (FMS)

- Application System (AS)
  - Alarm Reporting Subsystem (ARS)
  - Maintenance Analysis and Report Subsystem (MAS)
  - Administration and Operation Subsystem (AOS)
  - Meter Reading Subsystem (MRS)
  - Energy Management Subsystem (EMS)
  - Usage Sensitive Pricing Subsystem (USS)
  - Polling and Premium TV Rating Subsystem (PRS)

- Operating System (OS)

- Database

ECONOMICS

In production level quantities (50,000 units per year) Omnitel™ II integrated broadband multiplex equipment is expected to cost (1979 dollars) in the range of $300. per subscriber (basic system) to $600. per subscriber (fully loaded system). The cost of the basic system is comparable with many existing coax based polled data type systems but has the advantage of upward compatibility to the truly maximum capability of the fully loaded system which includes builtin capabilities for videotex, digital telephony, and interactive switched video. In the fully loaded configuration the integrated broadband system is expected to be in the order of 40% less expensive than any approach based on using seperate facilities for each major service group.

CONCLUSIONS

In addition to its many long term cost and operational advantages, the integrated broadband systems approach is the only one that makes it possible to offer new services requiring co-ordinated control of multi-mode communications. One example of this is the "Real Estate example" which requires the co-ordinated use of telephone, videotex (Alphanumerics and Full Color Video Image), as well as the interactive switched video mode, to accomplish a complete service to the customer.

In concluding I wish to say that it is our view that integrated broadband multiservice distribution system technology, such as embodied in Omnitel™ II and Omnitel™ III, can and is likely to be used by both cable television and telephone operating companies working in either a cooperative or a competitive regulatoryframework.

The coax option is the only viable broadband distribution technology between now and the mid-eighties. Although the fiber option is likely to then rise to prominence, it probably won't be until after 1990, that there will be enough facility in place for fiber to be a significant factor in the distribution part of the network.

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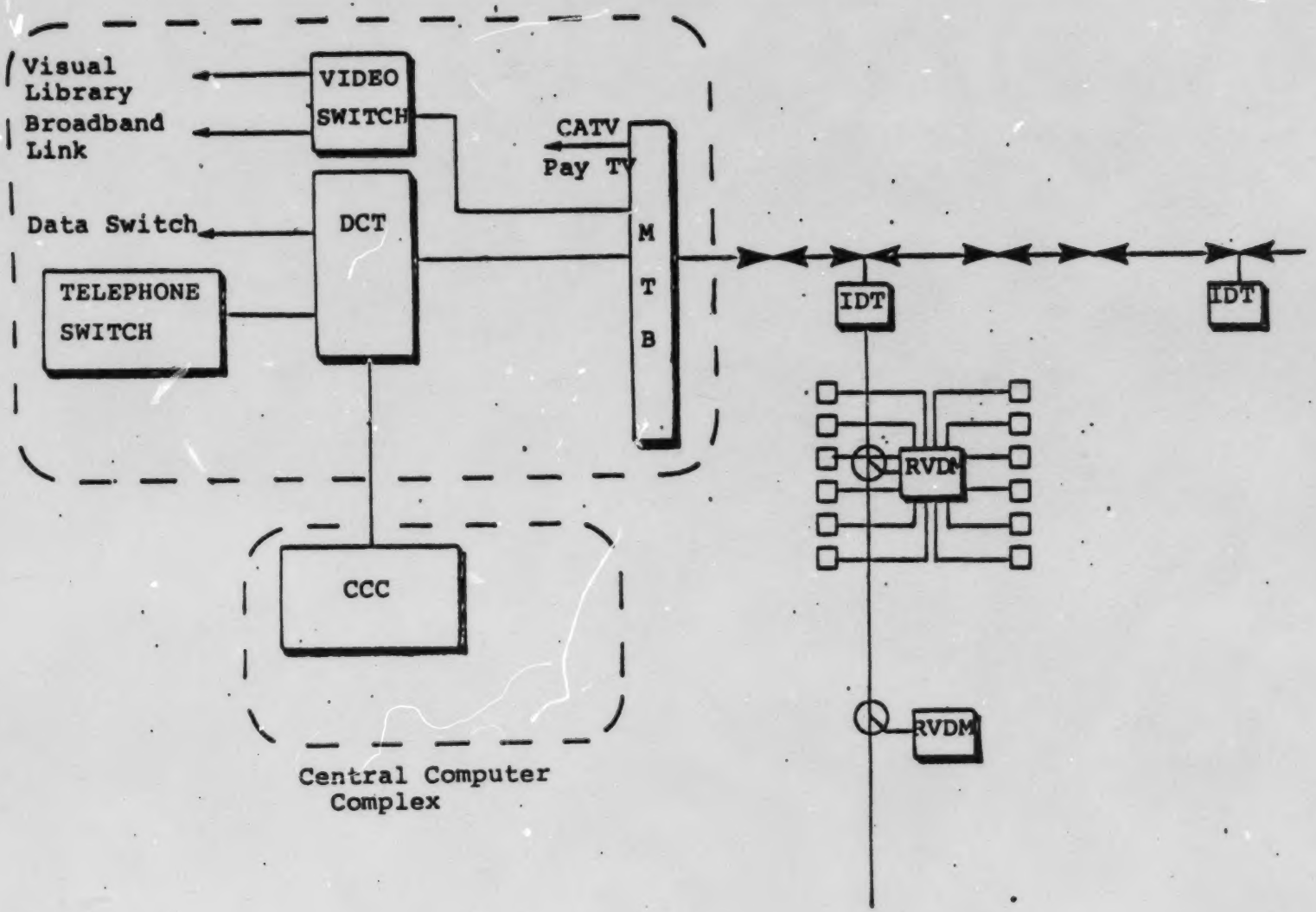
# OMNITEL™ SYSTEM - SERVICES

Figure 1

| | OMNITEL I | OMNITEL II | OMNITEL III |
|---|---|---|---|
| TELEPHONY | ● | ● | ● |
| DATA (OMNITEL) | | | |
| -ALARMS | ● | ● | ● |
| -METER READING | ● | ● | ● |
| -ENERGY MANAGEMENT | ● | ● | ● |
| -USP | ● | ● | ● |
| -POLLING | ● | ● | ● |
| DATA (GENERAL) | | | |
| -CIRCUIT SWITCHED | ● | ● | ● |
| -PACKET SWITCHED | ● | ● | ● |
| -TELETEXT | ● | ● | ● |
| -TELIDON | ● | ● | ● |
| CATV | | | |
| -GENERAL | | ● | ● |
| -PAY TV | | ● | ● |
| SWITCHED VIDEO | | | |
| -RECEIVE ONLY | | ● | ● |
| -TWO WAY | | ● | ● |

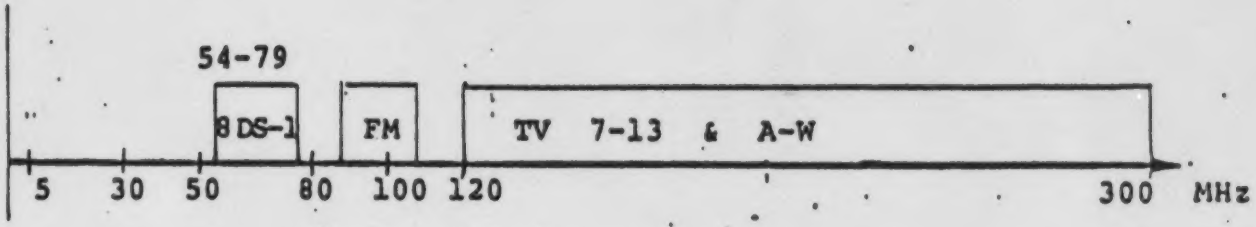



OMNITEL™ II DISTRIBUTION SYSTEM

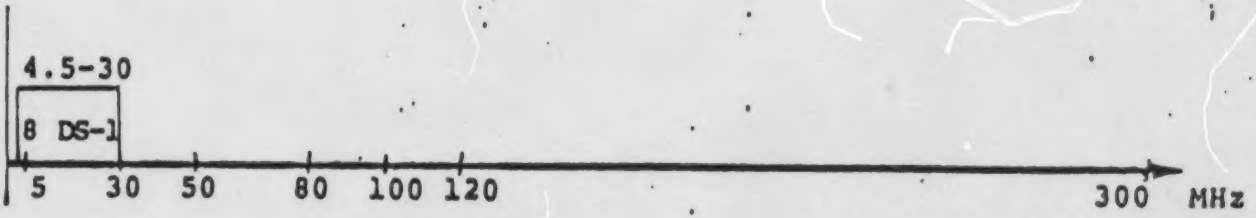
Figure 2

DCT TO IDT

TO IDT




TO DCT

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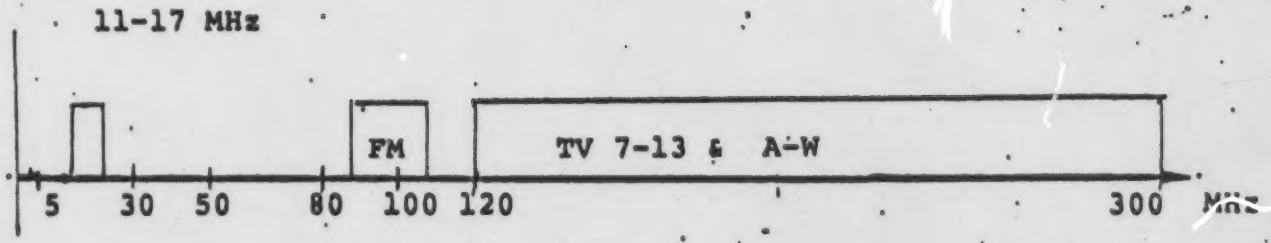
FREQUENCY ALLOCATION

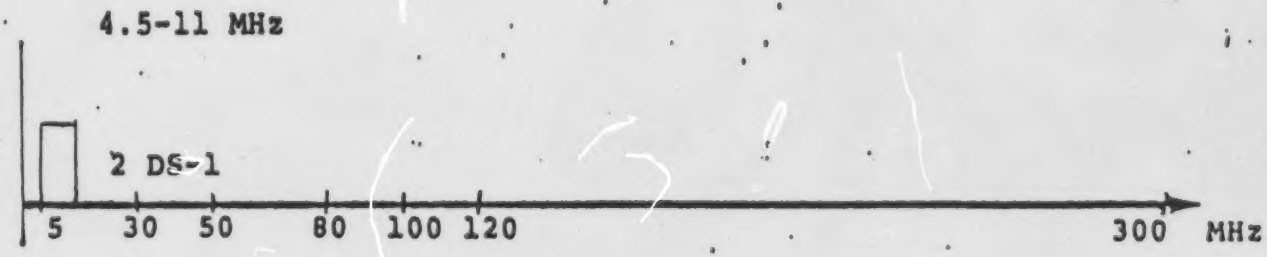
Figure 3

IDT TO RVDM

TO RVDM




TO IDT

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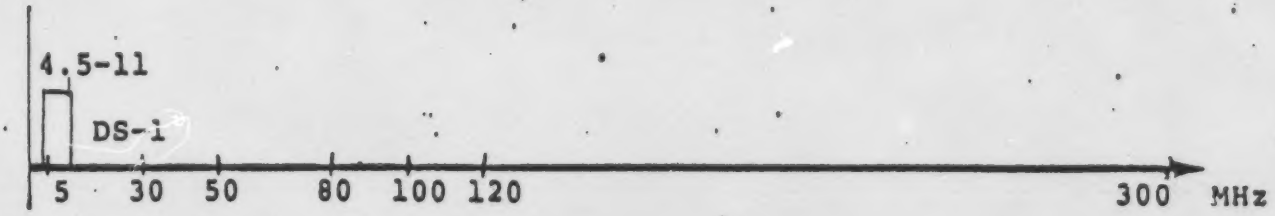
FREQUENCY ALLOCATION

Figure 4

## RVDM TO STU

TO THE STU

TO THE RVDM

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FREQUENCY ALLOCATIONS

Figure 5

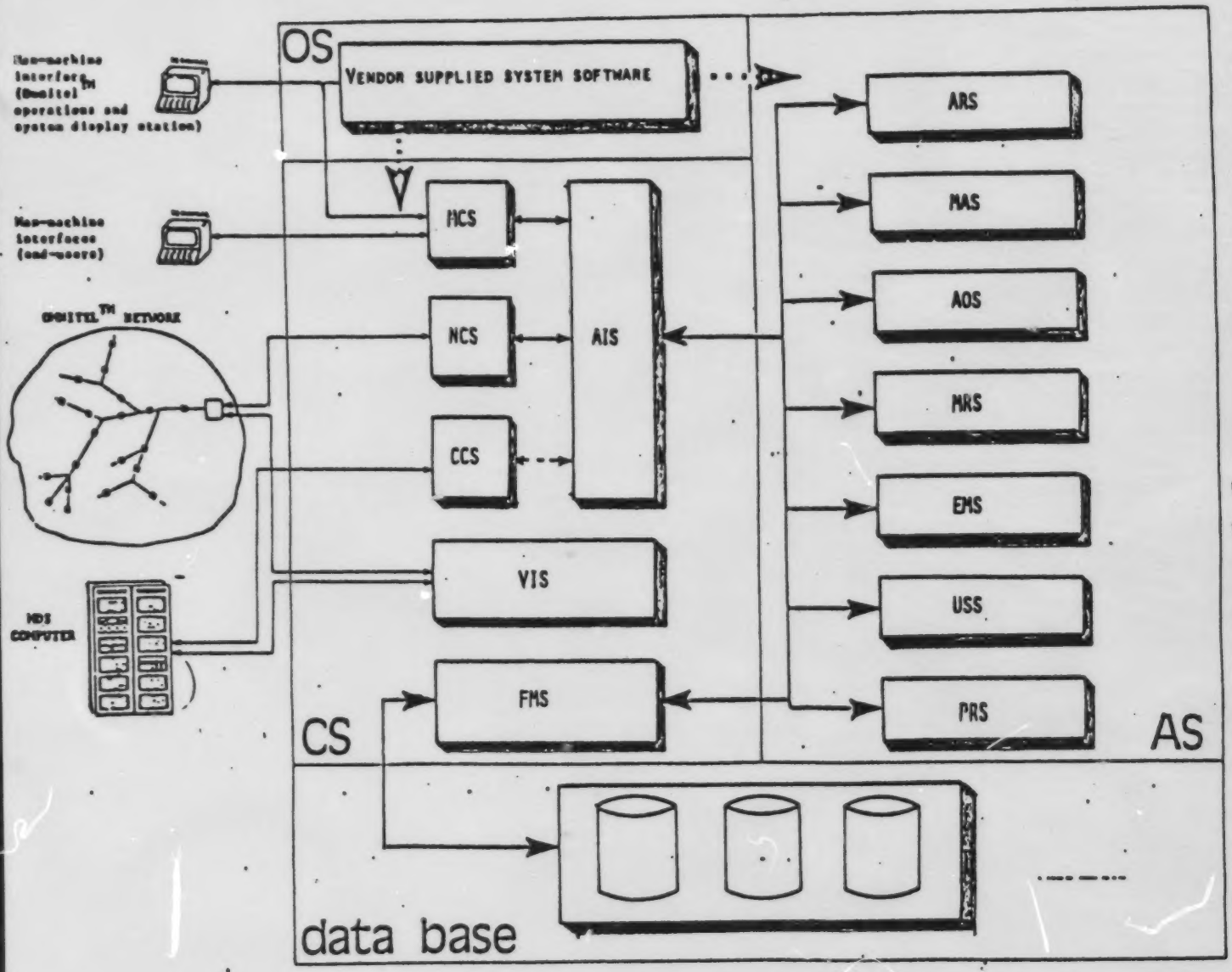
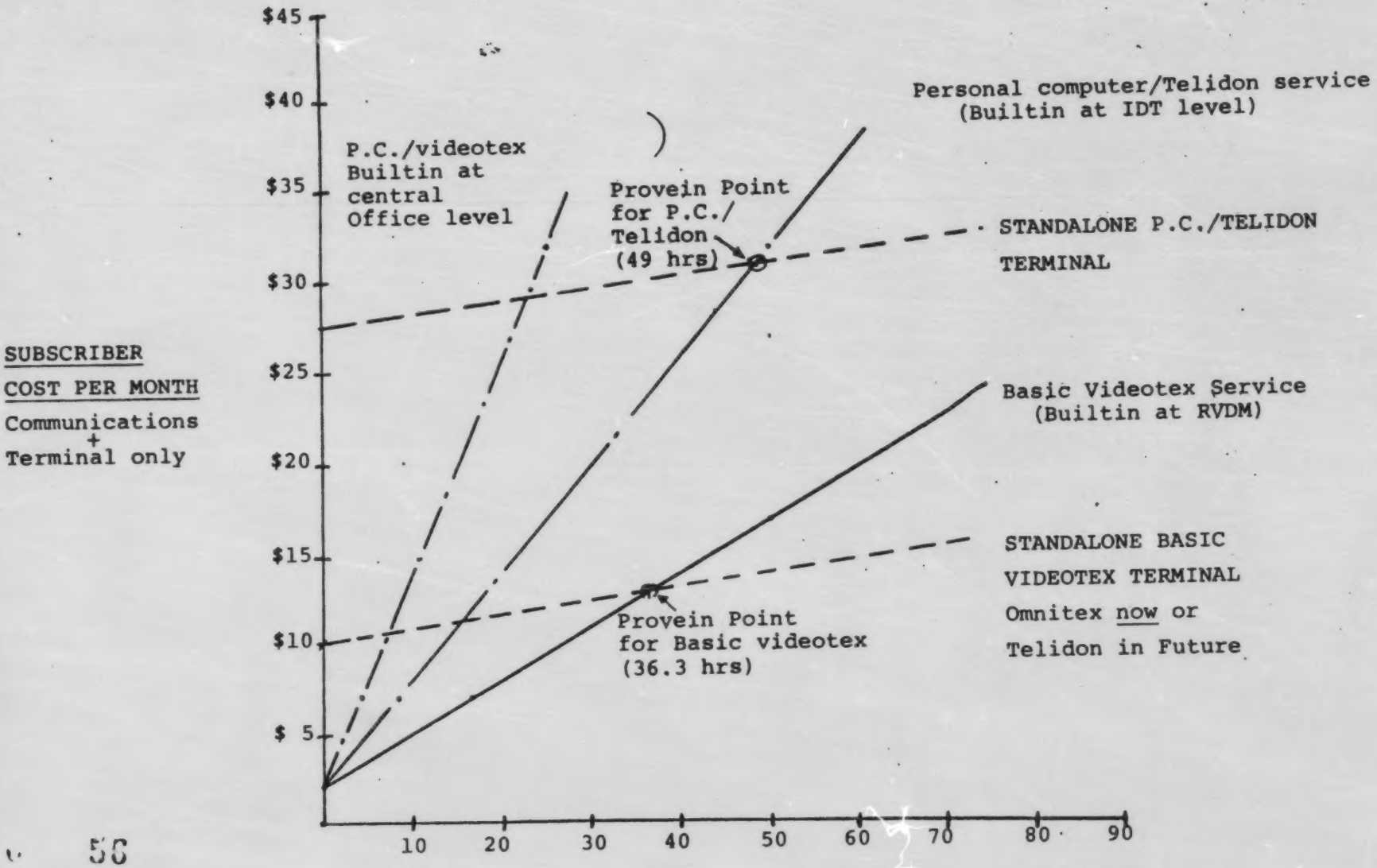

OS
VENDOR SUPPLIED SYSTEM SOFTWARE
ARS
MAS
AOS
MRS
EMS
USS
PRS
MCS
NCS
CCS
AIS
VIS
FMS
CS
AS
data base

Figure 6

COST COMPARISON OF PERSONAL COMPUTER/VIDEOTEX SERVICES - BUILTIN VERSUS STANDALONE TERMINAL

(Issue Date: June 5/80)

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# DATABASE STRUCTURES
# FOR VIDEOTEX APPLICATIONS

by

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novembre 1979

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## ABSTRACT

This paper is intended for two purposes. First, it gives an appreciation of the principles, capabilities and evolution of videotex systems and technology. Second, we discuss some aspects of information retrieval and data distribution in the videotex framework, and on their impact on the underlying database and directory structures.

Gecsei, Bochmann

## 1 - INTRODUCTION

The fundamental ideas underlying videotex systems are (a) the use of a modified television set as a home terminal, and (b) employing digital coding and transmission of information (in addition to the traditional analog transmission of TV signals). This opens the access for the general public to all imaginable information and computer services - directly at the user's home. Among the many implications for the future of society let us mention here only one, perhaps the most important to our minds: Videotex has the potential to replace transportation by information, in the sense that many professional and private activities, today requiring physical tranportation, will be done from the home. There is no need to detail the enormous potential of such developments for saving energy and time.

Historically, videotex is coming about in the wake of several developments like LSI technology, cheap communications, home computing, pay television and instant polling. The latter two are sometimes called "subscriber response services" and they can be considered as primitive instances of interaction with users. There are presently several information retrieval systems in the early operational or development stages. We mention the pioneering Prestel [19] and Ceefax [20] systems in England ; similar efforts are under way in many other countries. "Second generation" systems, functionally somewhat different from Prestel are being developed in Canada (Telidon), France (Antiope) and Japan (Captains). The initial application of all these systems is providing low-cost access to databases of general interest to nonexpert users.

From the technical point of view two classes of systems can be distinguished:

* One-way systems (without feedback from the user). Such systems are known under the generic name "teletext". In the absence of selection facilities, the whole database is periodically broadcast as a sequence of numbered pages. The user selects the page he wants to display (e.g. from a printed directory), enters its number in his terminal and waits until the page is transmitted and "grabbed" by the decoding circuits in the terminal. The main disadvantage of this approach is the limited size of the database. However, the number of simultaneous users is unlimited.

* Two-way systems (sometimes called "videotex" or "viewdata", with user feedback). This interactive approach permits much bigger databases, but at the price of limiting the number of simultaneous users. The distinction between the two types of systems is sometimes blurred, as in compromise proposals like "pseudo-interactive" [7] or "touchtone teletext" [18] systems . Following [16], we use in this paper the term "videotex" for both types of systems.

The purpose of this paper is twofold: first, we give an appreciation of the principles and capabilities of videotex technology (Sec. 1 and 2). Second, we discuss certain aspects of information retrieval and data distribution which have an impact on the database structure in the videotex context (Sec. 3 and 4).

## 2 - SYSTEM COMPONENTS

In a typical system, we distinguish three basic components: the terminal, the communication subsystem and the applications (services) available to users.

2.1 - Terminal capabilities

The following is a brief list of functions found in today's videotex terminals (marked by x), followed by probable futur. extentions.

Input functions:

- (x) keypad (for simple commands, numerical multiple choices);
- full keyboard (entry and editing of text, multiple choices, keywords);
- joystick, lightpen or mouse (interactive graphics, teleconferencing, CAI);

Output functions:

- (x) TV screen (used to display text, alphamosaic and geometric graphics or photographic imagery [11]);
- high resolution screen;
- voice output;
- hard copy devices;

Internal functions:

- (x) decoding of page numbers, character generation;
- (x) microprocessor-based generation of graphic displays;
- execution of programs received from a database ("telesoftware" [12]);
- local programmability, e.g. in Pascal or Basic;
- local mass storage, e.g. to store information from the database for subsequent local use.

2.2 - Communications subsystem

Various communication channels are (or will be) available to videotex systems. Some of them are: TV broadcast, cable TV, telephone, two-way cable, two-way optical fibers . When TV channels are used, videotex signals can be sent either over the whole bandwidth of a channel, or during the vertical

blanking interval between half-frames. The latter case evidently yields much slower transmission, typically .25 sec per page. Telephone is used in most todays interactive systems. Further details on transmission techniques, standards and proposed network configurations can be found in [7], [11], [15], [16], [18].

## 2.3 - Videotex applications

It would make little sense to attempt to give here a list of possible applications of a technology in fast evolution; (see, however, Ch. 19 of [7] and [11]). In order to give some idea of the range of possible applications, we may consider a classification according to the following characteristics:

* Degree of interaction. Most applications range somewhere between retrieval in one-way systems and highly interactive programs, like CAI.

* Ratio of database search to computing. Initial applications stress the search aspect and need little if any processing (except for tasks direcly linked with the retrieval). "Classical" programming, or playing chess are at the other extreme.

* Degree of data sharing. All information is shared by all users in public databases. On the other hand, special interest groups or individuals may have their own private data in a public database system.

* Degree of local processing by intelligent terminals. Local processing generally tends to reduce interaction with the remote computer, as well as response times. Since terminals must have some processing power in order to control the display, execution of user programs will be possible at moderate incremental cost. CAI is an attractive candidate for such local processing.

2.4 - Evolution of videotex

We can attempt - with the usual reservations - to predict the future evolution of videotex technology. We distinguish (quite arbitrarily) three phases, roughly corresponding to the present, the near future and the "far" future (which actually may be very near).

Phase 1 - Emphasis is on low cost applications to nonspecialized users. Services are provided by dedicated "local" computers closely integrated with the communication provider. Typically one service (e.g. acess to a database) is provided.

Phase 2 - Diversification toward more complex and specialized services will occur; for example, access to several independent databases, interworking between geographically distributed databases through public communication networks. Other applications of general interest may be offered such as store and forward message delivery, personal filing and computing, shopping transactions, games.

Phase 3 - Generalized information utilities will be developed. With progressive informatization of society (which seems inevitable), and increased transmission bandwidth to reach the homes, the videotex terminal may evolve into a universal home terminal for innumerable applications of which data retrieval is only one. A possible configuration is shown in figure 1 (components marked by "x" are present in Phase 1). Some important applications are financial transactions, CAI, work at home, electronic mail, instant opinion polling and access to specialized knowledge bases. These applications will run on different computers; the local videotex computer may provide go-between services such as billing, advising users etc.

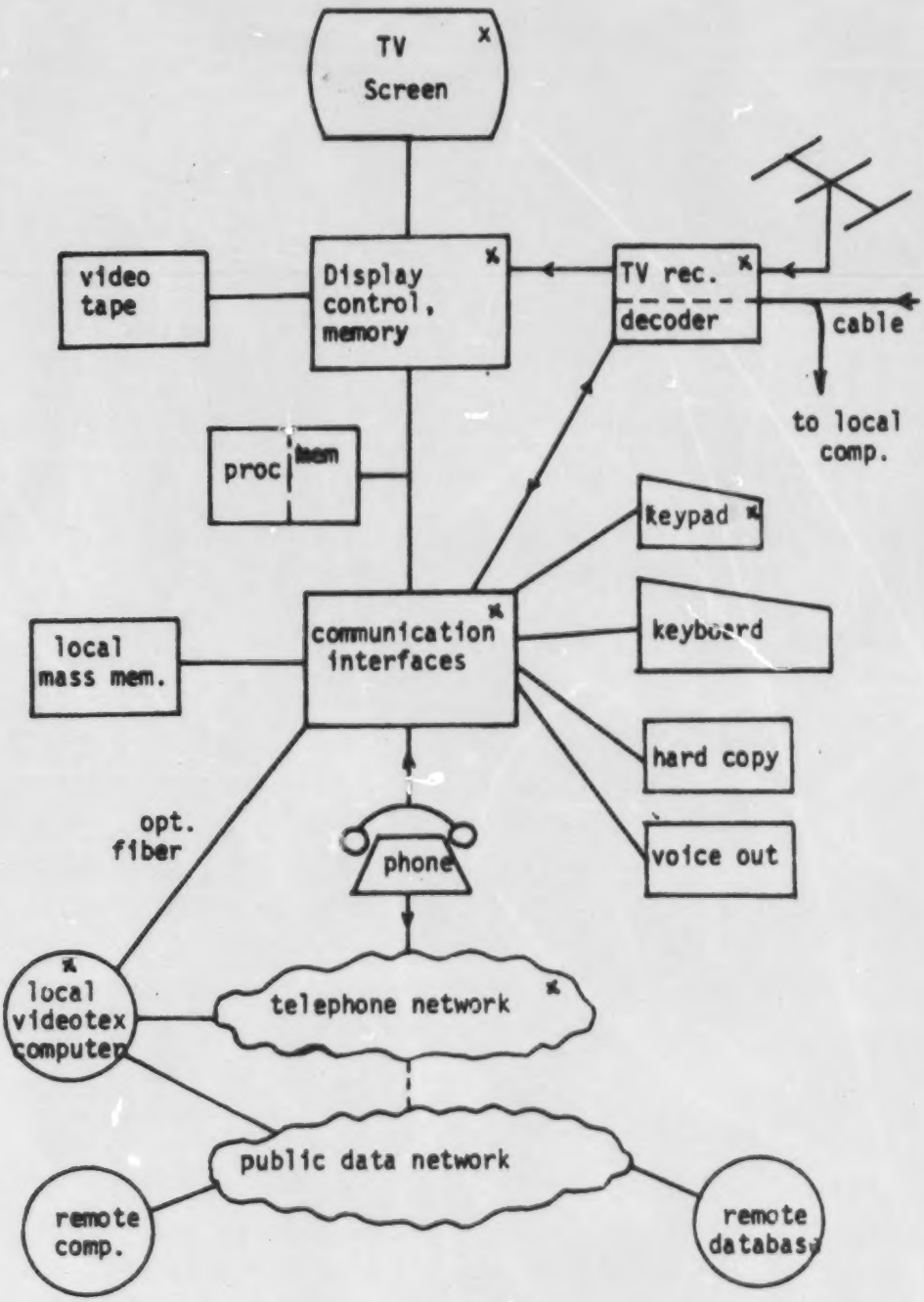


Figure 1

Videotex system configuration

We should not rule out the possibility that somewhere on the way, display technologies more adequate than the TV set will be discoverd. Then videotex might continue to exist in a limited form, such as noninteractive broadcast of a medium-sized public database over a full cable TV channel.

## 3 - DATA STRUCTURES FOR RETRIEVAL APPLICATIONS

In the following subsections we discuss the mutually interdependent aspects of display, search procedures and data structures applicable to present and future videotex information retrieval systems.

### 3.1 - Page orientation

Due to the nature of videotex terminals, the basic unit retrieved from the database and displayed on the screen is a page. A segment is a collection of pages containing information of a certain type and structure. A data base is a collection of segments. Examples of segments are:

- a news article
- the wheather map of Canada (1 page)
- the inventory of a supermarket (or some part of it)
- a directory page containing information for a multiple choice selection.

A segment can be displayed simultaneously (if it fits in a page), or as a sequence of frames in roll mode or page mode. The former is more suitable for continuous text, but it requires local processing in the terminal.

In a refinement of the above mechanisms, displayed pages can be changed incrementally by adding or removing some elements (provision for this is made in Telidon [16]), or by selectively changing display attributes

(flashing, color). Information for such incremental changes may come from special pages in a segment or it may be generated by a local or remote program.

In such page-oriented databases, the pages contain mostly unformatted information, and most search procedures do not use the data within pages. The information in a page is most likely to be stored as a contiguous physical record.

3.2 - Search procedures and directories

The ANSI/SPARC architecture of database systems [7] specifies three levels: the external, conceptual and internal. Here we are mostly concerned with the external level, that is the user's view of the database. Since all users share the same view (at least in the first, relatively unsophisticated videotex systems), the conceptual structure of such databases will be very similar to the external user's view. In practically all present systems this view is based on a segment directory. Each segment in the database is uniquely named. The directory contains all information necessary for the user to obtain the desired information through a series of simple interactions. We remark that the distinction between data and directory is not always clear; a given page may conain both kinds of information.

A natural way of organizing the directory is in a hierarchical structure, where the higher levels in the hierarchy represent the information in a more "abstract" form. This structure allows the user to find the desired information by successive refinements and inclusion of more detail. Such an approach leads to the familiar tree-structured directories in present videotex databases, in which a segment name represents the path through the tree from the root to the segment. Segment names are usually numerical, to allow user

feedback from simple numerical keypads.

We distinguish the following four user feedback procedures. The first and partly the second are implemented in present systems.

(1) Direct selection. It can be used when the user knows the segment name (from previous experience or from printed directory [9]). The segment is obtained by entering directly the segment name.

(2) Multiple choice procedures. The user is presented with a sequence of multiple choice "menus", each corresponding to a level in a tree-structured directory. The user follows a path to the desired segment by entering his choice at each level. Commands for backtracking are usually available. For certain applications a numerical multiple choice is sufficient. Other cases may require more flexible facilities, such as (a) choice among a given set of keywords, (b) pointing to a chosen area on the display, or (c) free-style response, which must be of course interpreted by the system (possibly locally), in order to determine its meaning.

A modification of the tree structure permits sharing of the directory or information segments between several retrieval paths. This is exemplified in fig.2, where segment G may be reached from segment A through retrieval path A-M-N-I-J-K-G, as well as through A-B-C-D-E-F-G. Such directory structures may be characterized as acyclic graphs.

It is not clear whether cycles should be avoided in directories. figure 2, for example, contains the cycle G-N-I-J-K-G which seems to be useful.

(3) Search by keywords. Although not available in current videotex systems, it seems that it would be useful in a variety of applications of general interest such as yellow pages, dictionaries or bibliographical information. Several technical points have to be considered here. First, the

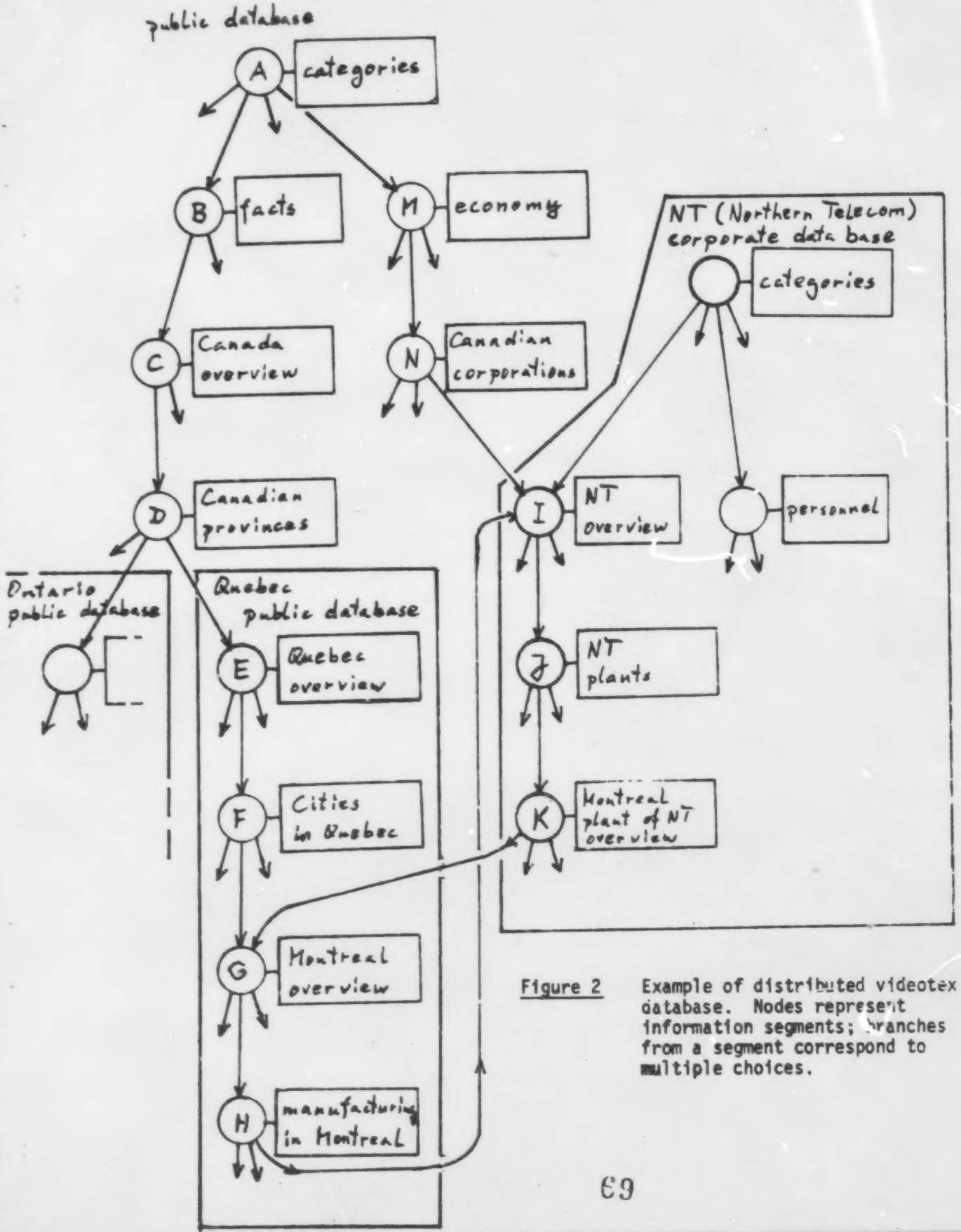


Figure 2 Example of distributed videotex database. Nodes represent information segments; branches from a segment correspond to multiple choices.

scope of the search may be limited to a special keyword field in each segment, or it may extend over the whole (unformatted) data contained in the pages. The latter case would require some form of content-addressable mass memory such as described in [17]. Without efficient content-addressability keyword searches would result in excessive processing loads in the host computer even with a limited scope of search.

Experiments with public use of specialized online databanks through the intermediary of public libraries have been reported in [2], [5] and standards are being proposed for user interfaces of similar retrieval systems [1], [4], [13]. When videotex will be accepted by the public, it is possible that the level of sophistication of a large group of users will warrant the implementation of such services.

(4) General queries in formatted files and databases. The most common types of formatted databases are exemplified by the relational, hierarchical and network models. All information in such databases is formatted into fields, records and files, and the scope of queries generally extends over a file or the whole database. Segments and pages as discussed above, loose their original significance. The typical user interface is a query language (e.g. [14]) or a general high level language such as COBOL. This allows much flexibility in the formulation of queries, but it requires special knowledge by the user, and the query execution generally involves much searching and processing. Therefore it is not likely that initial implementations of public databases will support such facilities. On the other hand, some applications of potentially wide interest (such as corporate databases) are using formatted databases.

## 4 - DATABASE DISTRIBUTION

It is likely that the range of videotex applications becomes so wide that all necessary information cannot be included in one giant database. Instead of feeding their information into one common database, information providers will construct and maintain their own database and make it accessible to the users. Alternatively, it will be possible to access other databases (developed not specifically for videotex), from videotex terminals. Already at the present a great number of specialized databanks are functional (e.g. bibliographical, medical information, news agencies) in many countries. To list all such available services, a "superdirectory" will probably exist in some local videotex service centers.

In our perception there are two major alternative (but not exclusive) paths for future evolution:

(1) In spite of all standardization efforts, these different systems may (and already do) become too heterogeneous in purpose and structure to comply to one set of fixed standards. However, it is possible and desirable to provide at least standardized descriptions of services offered by these systems. As far as the user interface is concerned, (standard) commands like HELP are extremely important [13]. They should provide a description of user commands and interactive assistance or programmed learning a la CAI. And let us not forget the role of enlightened human operators (as in todays telephone systems) who would advise the user in trouble.

(2) Some kind of standards will be adapted by at least a part of service providers. Standardized database structures and interfaces for videotex applications have important advantages for user acceptation, system development and information exchanges between databases. Similarly structured

databases may complement each other, which may lead, in the extreme, to the impression of a single (distributed) database as seen by the user. Alternatively, an originally centralized database may become physically distributed without affecting the user interface. Reasons for such distribution may be (a) to minimize communication costs (when there is high local demand for subsets of segments in different geographical areas, such as local news or advertisements) and (b) to optimize throughput (one centralized database cannot handle all requests for access; multiple copies of the same information, especially directory segments, may be available in different locations).

Figure 2 shows an example of a possible distribution of segments over several physical sites. The upper part of the directory may be duplicated in all sites. But in spite of the distribution and multiple copies, the users may perceive a homogeneous database structure. A research project in this direction is currently under way at the Université de Montréal.

Multiple copies of information and relations between different databases, as shown in figure 2, bring up the problem of consistency when updates are performed separately on the different databases. The urgency of this problem depends on the nature of data in question. For example, it is much more important to keep consistent data on stock prices than on job statistics.

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# POSITION PAPER

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## Integration of an alphageometric information system to a two way coaxial cable network

The aim of the project is to prepare a field trial to offer Teletext and Videotex services using the canadian Telidon protocol. In particular, we must adapt to our trial the maximum proportion of the basic software developed by the Communication Research Centre (CRC) of the Department of Communications (DOC). Moreover new functions and greater performances are required from the telecommunications and computer components.

The work was concerned mainly with the evaluation of the structural and fonctional caracteristics of the CRC data base which is implemented in a DEC PDP-11 model 60 mini computer, using the RMS-11K software. We have observed that the required performances for the field trial (for a few hundred users) and the long term commercial operation of Telidon necessitate at least a computer of the DEC PDP-11 model 70 class. That machine because of its larger main memories can use more evolved operating software such as the RSX-11M-PLUS and the DMS-11.

We have started the design work for the data base taking into account a large number of parameters where the main ones are:

1) Average length of an information page is bytes

2) Length of a request in bytes

3) Number of simultaneous requests that can be processed by the central computer

4) Number of requests arriving at the central computer per unit of time

5) Number of disc access required to retrieve the requested information page

6) Number of pages in circulation on the cable

7) Number of users serviced

8) Proportion of information pages stored in the local information bank

9) Proportion of information pages stored in the remote information bank

10) Disc access time

11) Users waiting time

12) Waiting time of a request at the head end

13) Average number of requests in the queue

The mathematical analysis and the computer simulation have given results which will allow the selection of an adequate hierarchy of main memories and secondary memories for the data bank. Moreover the simulation of message traffic will allow to estimate the size of the frequency band required on the coaxial cable.

Figure 1 shows a sample of results obtained from our simulation.

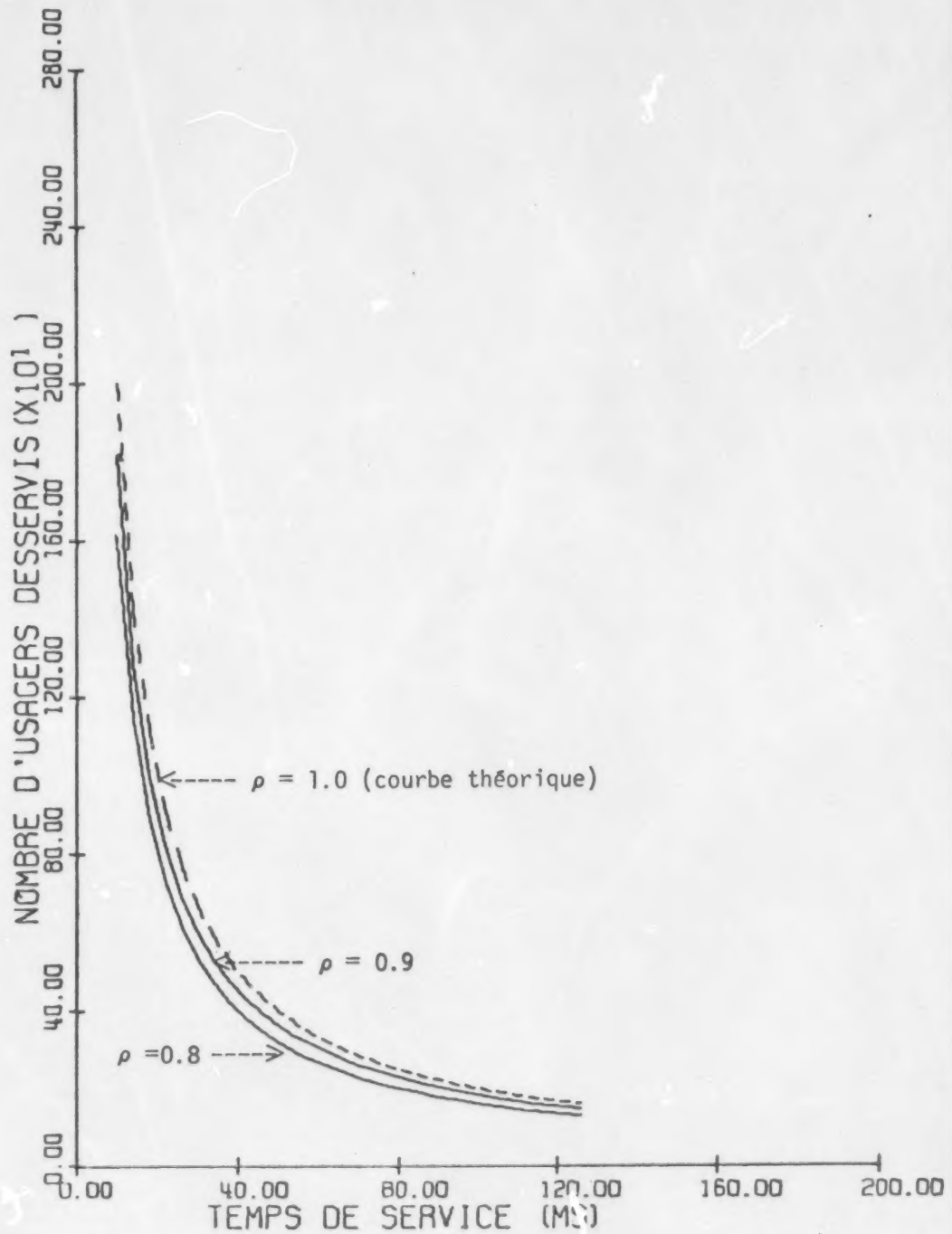


FIGURE ~~5.15~~ : NOMBRE D'USAGERS DESSERVIS

The most distinctive and most unfamiliar characteristic of Prestel and other viewdata systems is the structure of the database. Many people, especially those reared in the world of newspapers and magazines, see viewdata as just a sequence of pages. Even those familiar with teletext tend to see viewdata as just a different way of displaying a larger number of screen pages. Yet the design of the database structure is the most fundamental activity involved in setting up a viewdata information service. Without a good database design, the information service, whatever its information content, is dull, lifeless, hard if not impossible to use and, perhaps most importantly, fails to exploit the distinctive features of viewdata to create a distinctive product.

Almost as bad, there is a half-way house of computer and other experts who understand that these viewdata services have a structure, but have interpreted that structure, on the analogy of other structures of computerised information systems, as a "tree structure". Articles and lectures abound in references to the tree structure. There is no tree structure: it does not exist, except here and there by choice. It is a pernicious concept that is almost as bad as having no conception at all - maybe even worse, since with no preconception the mind is at least free to grasp the reality.

The reality, and indeed the basic peculiarity of all viewdata systems, is that any page (a page being a single screenful) can have attached to it up to 10 automatic links or routings to any other page. Thus the user can be told, when looking at page 10, that by pressing 1 on his keypad he will be taken to page 531078542 (or rather, to the information on page 531078542, since the user is not interested in the page number as such), and that by pressing 2 he will be taken to page 24807 (or the information on it), and so on. Only slightly less important as a peculiarity is that the user can get to any page at any time by simply keying the page number. Thus if he knows that the information he wants is on page 24807, he keys 24807, plus two control keys and there he is.

It is up to you, as the editor or manager of the information service you are offering to the user, to make what you will of these two characteristics. Whenever a page of information is first created on viewdata the editor working on it, or

operator, call him or her what you will, first has to fill in a "shadow page" of instructions that the computer attaches to the page of information. This shadow page is the permanent companion to the information page, although invisible to the user. It is, as it were, the dark side of the moon. On this shadow page are entered the page number, page price, whether it is for general public access or restricted access only, and finally the routings or links for the information page, from 0 to 9. The editor may fill in all, some, or none of these, at his choice. But his choice it is, and the effect of his repeated choices, page by page, is to create a structure to the information, that is external to the information itself, but whose objective is (or should be) to aid the user to find what he wants.

Each page on Prestel has a unique page number, from 0 to 999,999,999), and in theory each of these has sub-pages, or frames, denoted by the letters of the alphabet "a" through to "z". Hence the theoretical capacity is 26 times 999,999,999. In practice, the first Prestel computers had a capacity of 250,000 pages, about 160,000 of which were in use by 1980. The way that Prestel is organised in practice is that the Post Office itself (i.e. the system operator) creates a series of master indexes to the total database, beginning on page 0: and the individual IPs, of which there are over 100, are given (or rather leased for money) three digit numbers as their individual master numbers. Hence Fintel starts on page 248, the Birmingham Post and Mail on 202, American Express on 269, and so on. Three digit numbers are Prestel's status symbols: without one, you are known, a trifle derogatorily, as a sub-IP, since you have to use pages provided by someone else who has got a three digit entry point. With a shortage of pages such as occurred in 1979-80, there developed a sort of black or secondary market in spare pages.

All the information provided by a particular IP sits "underneath" his three digit number, and in practice most IPs have tended to divide pages between index pages, which tell the user what he will find and the numbers to press to get it, and information pages, which are the user's final goal. There is no technical reason why this distinction has to be made, since, as we have seen, every page can have both onward routings and information. But it is

a convenient distinction. One problem however that the creators of large databases have quickly found (those, say, of 5,000 pages or more) is that the larger the database, the greater the number of index pages as a proportion of the total, since the user may begin his inquiry in a number of different ways, and may wish to pursue it in a number of different ways. For example, cinemas or movie houses may have to be indexed alphabetically; by location; by price range; and by hours of showing; and the films or movies showing may have to be indexed alphabetically, by type (horror, cowboy, art etc.) and by date of release (new or old) or even by country of origin.

Unless you cater for the many possible motivations of the inquirer, you will quickly lose him, or not get him in the first place, since he cannot easily find what he wants. It is not uncommon to end up with as many index pages as information pages; or indeed more. Now it is becoming increasingly rare to charge for index pages - how can you charge the user for discovering that what he wants is not there? As a result, half your pages may be carrying all your costs as an IP.

As one answer to this problem, some IPs have consciously tried to abolish the distinction between index pages and information pages, as they are technically free to do, and to give information on all or most pages, simply varying the amount according to the number of routings that have to be given as well. That way, all or most pages can be charged for, and the user is spared the often tedious business of wading through large numbers of index pages before he gets to something interesting.

The disadvantage is that the Prestel page is so small. It has only 960 characters, of which only 858 are in practice usable, given that the top and bottom lines are reserved for system use and that the colour coding at the beginning of each line, except for white, takes up a character space. So even with only 1 or 2 onward routes displayed and described (eg. Press 1 for horror movies) let alone 4 or 5, the amount of space left for actual information gets increasingly constricted. If you are trying to give value for money, especially on high-priced pages aimed at the business market, you cannot give over half the page to non-information content. Each IP must find his own balance between these factors - as long as it

is realised that there is a choice, or range of choices.

At this point, it is necessary to step back and ask, what is the overall structure of all these index pages, not to mention information pages, that you as editor or manager of a substantial database are creating? After all, neither the user nor indeed the editor ever sees all the pages at once, or even at one session. It is not like flicking through the pages of a 40 page or even 100 page newspaper, where you can see the overall structure of the product almost at a glance. Unless there is a consciously designed architecture, preferably expressed on paper, pages get lost, the editor does not know where to put anything, let alone where to direct the user, and the user does not know where to find anything. This is why, incidentally, it is not usually possible to generate either random or even sequential page numbers on a computer-to-computer transfer of data to Prestel. The need for an explicit structure makes it important that many sub-numbers remain the same (eg. the page number of the main local cinema, which customers get used to) even though the quantity of information may vary (eg. how many movies, of what types, are showing there this month).

As we have said, computer people, familiar with the notion of a tree structure, have also seen videotex as a tree structure, or rather an inverted tree structure. They see it, in its crudest form, as a system in which the user is first offered an index with 10 general choices and, having made his first decision (eg. business information), is then offered a second index, a little less general, and makes a second choice (eg. market prices). He is then offered a third index, and makes a third choice (eg. share prices). A consequence of the way that Prestel is organised, and therefore a peculiarity of it, is that the user is then offered yet another index, showing the various organisations providing share price information, and he makes a choice (eg. the Stock Exchange). He is then confronted with the indexes of the Stock Exchange material itself, created by the Stock Exchange: these could be, first, a list of industry sectors, and second, an alphabetical list of company names, and only after making these further choices does the user eventually get his share price.

This quite realistic example shows that the user has to go through six indexes to get to the end information and illustrates the "index page overhead". It is also the reason why there is a strong move to give the user the exact page number of the information itself, either by advertising or in the form of directories, rather like telephone directories, that he can look up, so that he can key the page number direct. It also raises the interesting question of whether the user will really be conscious of the transition from Post Office indices to IP indices, and whether he will really perceive the system as a single, Post Office information system, whatever the formal arrangements. But once a user has penetrated into a particular IP's database, one object of that IP's indexes and routing will be to keep that user inside his database, rather than have him wander off elsewhere.

But the question remains, is this picture of an inverted tree structure a valid one? Is it sufficiently valid to be made, as it is so often, the fundamental information structure of Prestel and of other viewdata systems? The supreme disadvantage of the tree concept in its pure form is that once the user has got to his destination page, what can he then do? Presumably, either ring off or start the whole laborious process all over again. He may be reluctant to do either, and anyway it could be disastrous to the economics of the system if the user only looked at one page each time he dialled in. This is known in the trade as the mineshaft syndrome.

So what do you do? What you do is to put on each and every information page details of further related choices that the user can make, and enable him to make them simply by pressing one key on his keypad. Another movie house? Key 1. Another type of movie? Key 2. Another area? Key 3.

Once you start on this line of development, you are in fact allowing the information itself to dictate, within broad limits, the external structure within which it is contained; and that is as it should be. But it also means that different types of information with different users may have different structures. We have identified various different structures, variously labelled cartwheel, ring of rings, lobster pot, chinese lantern, and other multi-dimensional models, as well as the simple tree. But the essential

point is that they were originally created by editors working out for themselves how to present their information systematically, interestingly and dynamically on Prestel. Hence the inclusion of database design under the heading of editing; it is not, as so often presented, the computer manager's province, any more than the tree is anything more than one of a host of possible models or "architectures".

Prestel was conceived as a system simple to use, for the ordinary customer. Talk of complicated data structures often draws the accusation that one has destroyed the basic simplicity of the system. But the truth rather is that to attain simplicity for the customer, a truly desirable aim, the editor has to evolve complex architectures of information whose complexity is virtually invisible to the customer but whose objective is to cater for the variety and unpredictability of the information needs of even the simplest human being. As with a physical building, the result of complex architectural design is usually a beautiful simplicity of appearance, and therein, we are all agreed, lies the supreme beauty of Prestel as well.

But the question still remains, how consciously do you express these architectures?. Having discarded the notion of a tree, do you nevertheless evolve a limited number of alternative models, each laid down on paper, from which the editor/manager of your database can chose, but outside which he cannot stray? Some IPs do this, and it usually takes the form of constructing algorithms or formulae by which one page may be tied to groups of other pages according to their number sequences. For example, it may be laid down in one of the algorithms that given a page number 2487, then choice 0 on the routing always goes back to page 248 (since it is vitally important to give the user a return route as well as an onward route), while choices 1 to 6 always go to pages 24871, 24872 through to 24876, and choices 7 and 8 are left free for future expansion, while choice 9 is an 'optional choice' that may go anywhere, for example, to a related advertisement. Various such algorithms are possible, and exponents of this approach argue that the important thing is not the exact algorithms you use, since they will vary from application to application, but that you should as

an IP be aware of the need for them, have the algorithms that suit you, have enough of them to give a choice but not so many as to be confusing, and write them down so that everyone knows what to do and what is going on.

This is the formal but flexible approach, and it suits some. But for others it is still too formal. There must be general rules, capable of applying across large numbers of pages, otherwise the database is and looks a mess. But there may also be a need for a much larger element of discretion on the part of the editors, to allow them to use their imagination and knowledge of the database to create new and unexpected paths through it. Thus there may be (as in the company with which the author is associated) a rule that all pages must normally have at least two and often three routings attached to them: a rule that there must normally be a backward as well as a forward routing: a rule that there must normally be an easy path back to the front three-digit page: a rule that similar or identical types of pages must normally have similar or identical types of routing, so that distinct routing patterns emerge: and a rule that routing instructions are normally shown in a distinctive colour, at the bottom, at the left or at the right of the screen, as the preference may be. But these are much looser rules than those implied in the algorithm approach, and depend in the end on the common sense experience of the editors entering the pages. Clearly, with computer-to-computer transfer of data, strict rules about routing and indexing have to be drawn up before any transfer can take place, but even this does not, as we have mentioned, imply that it has to be a tree structure, as long as it is a regular pattern that the computer software can create and recreate. Whatever your approach, it must be one that strictly governs use of important 4-digit numbers (a scarce resource) and controls accurately the number of pages in use, which can otherwise get out of hand - an expensive mistake when every page costs money to rent.

Database structure raises one last and deeply absorbing topic for those interested in presentation of information. It is the role of the front-end indexes created by the system operator, normally the PTT. On most viewdata systems, it is the system operator who creates the initial top indexes - do you, the user, want business information, travel information, news, entertainment?

and so on. After several layers of refining the user's choice, these system operator indexes then give way to the indexes created by the actual supplier of the information, the Information Provided. It is worth adding that by this means the user may not necessarily come to the IP's 3-digit front page, but be taken direct to some subsidiary part of that IP's database. This is yet another reason why the user may not necessarily be very conscious of the separate identity of each IP, but rather see the whole Prestel service as some sort of unity from which he picks out bits.

But the fundamental question is, how far do these front-end indexes extend? This splits into two further questions. How deeply into the information can these indexes extend without becoming monstrous in size? And how far is it right that the system operator, as common carrier, should influence and control the access routes to the data taken by user? For clearly, he who controls the indexes controls the movements of the user and controls the commercial fate of the suppliers of the information. Indexing is not, repeat not, a neutral academic task, at least not on viewdata. It is not like a book, there the index is added last. The index is the key to viewdata, at least until such time as this index approach is modified by widespread use of directories and later by use of so-called 'Key-word searching' that enables the user to ask direct for 'Majorca' or 'BP' or 'Noughts and Crosses' using a full alpha-numeric keypad.

At one extreme, the system operator, the PTT, could just index the Information Providers, with a brief description of what each provides. Then it is up to the user to find out whether a particular IP has anything he or she wants, much like buying or not buying a magazine on a newstand (hence the frequently used term 'Electronic Bookstall' to describe Prestel and similar viewdata systems). At the other extreme, under the banner of making it as easy as possible for the user to find specific bits of information, the front index can reach further and further down towards, say, the time of the London-New York Concorde flights or the test reports on the latest Mercedes. The trouble is that on this philosophy there is, at least in theory, no end to the indexes, which threaten to swallow up the entire system. For example, on Prestel, is it possible to have a consolidated index of all companies and corporations mentioned? A reasonable idea, which may be implemented,

but it means an index covering perhaps 2,000 companies (maybe more in future) and half a dozen IPs. The index must take several thousand pages to construct, and the same might be true of a comprehensive index of all motor vehicles mentioned. These figures, spread over a wide and potentially unlimited range of topics, represent a significant overhead on a system that has, at present, an upper limit of 250,000 pages. It may even be that the effort to make it easier for the user in the end simply baffles him, by enmeshing him in an infinite pyramid of indexes. (Prestel participants have a fantasy in which the entire content of the Prestel computer is made up of the complex billing mechanism needed to make it work plus an all-embracing index structure, so that the residual information content finally dwindles away to zero)

No doubt practice and common sense will dictate a median index policy, and for those who run a dedicated viewdata system (for, say, stock market prices only) or run a controlled and managed database, not on the common carrier principle, these indexing questions are less formidable. But just because viewdata is a system that uses indexes, how to index will be a question of some complexity for any viewdata operator. Indexes are, after all, both part of the inner structure of viewdata and part of its outward appearance, its style. Every medium has its own style. Its style is part of the way in which its audience identifies with it. Prestel is rapidly developing its own style, or range of styles. There are five elements. Two are traditional in any form of publishing; the lay-out of the pages, and the editing of the text and figures on the screen. But three are specific to Prestel. These are the easy availability of colour; the indexes or routing structures; and the pricing of the information.

The lay-out of a Prestel page is governed by the format of 22 usable lines, each with 40 characters. It is a very small page, about half the capacity of a normal VDU screen; and it will hold a maximum of about 130 words. But is has to be visually pleasing, or at least not so hard on the eye that you cannot read it. Each page must be self-contained, look well-organised, and have an obvious visual continuity with other pages of the same or related content. Each Information Provider develops his own house-style to cope with his own particular information and the user will quickly realise that (for example) the Fintel magazine (or database, call

it what you will) on Prestel looks quite different from, say, the Consumers' Association magazine.

In the same way, the editing demands that something useful be said on each page without fuss or flannel in a very short space. Prestel does not like long sentences or qualifications. Nor must you cram too many words on to the screen; otherwise it looks a mess. Each page has to have a single message, and a clear one at that. Two short paragraphs to a page, broken perhaps by a blank line, or a few columns of figures to a page, are the most you will find, although a lot depends on whether the page is meant for the general or the specialist user.

Nevertheless, it comes down to what a newspaperman calls "tight subbing". The use of colour is totally different. It is a problem intrinsic to viewdata. Seven colours are immediately available at the press of a button. The question is, does colour help to convey information better than black and white? There is a theory, which I do not believe, that business users of Prestel will prefer black and white sets, and domestic users will prefer colour. Experience suggests that most businessmen also want colour, though preferably on a small screen.

So how do you choose your colours? Every Information Provider makes his own choice. He could, if he wished, have every word and every figure on every page in a different colour, within the seven available (white, red, light blue, dark blue, magenta, yellow, green). He may also replace the standard black background of the TV screen by a coloured background in any of the 7 colours.

The ability to display in seven colours has caused some Information Providers to change colour almost from paragraph to paragraph, for no apparent reason: and/or to choose jarring or almost illegible combinations of colour to carry their message. In practice, the range of colour available is deceptive, since the deep colours - dark blue, magenta, red - are hard to read, and should rarely be used, apart from graphic applications and for background. White is also to some eyes rather glaring to read in quantity. There remain light blue, green and yellow as colours that are easy to read and easy on the eye.

There is in fact an established 'luminosity scale' that in part explains these variations in legibility, although the fact that, for example, red letters can be put on a white background on the screen makes it important not to take the figures too literally. Nevertheless, they are instructive.

| COLOUR | COMPARATIVE BRIGHTNESS |
|---|---|
| WHITE | 100% |
| YELLOW | 89% |
| LIGHT BLUE (CYAN) | 70% |
| GREEN | 59% |
| MAGENTA | 41% |
| RED | 30% |
| DARK BLUE | 11% |

In short, colour on Prestel must be seen in low key - comparatively few graphics, and comparatively few restful colours for the text. Nevertheless colour is valuable, if used with discretion. Individual pages can be made more attractive to look at; their information content can be made clearer; a consistent house style can be given to an individual database; the division between the information content of a page and other (eg. routing) material can be made obvious; and last but not least colour can be used to make up for some of the limitations of the size of the screen. The use of colour can to some extent take over the use of white space in the lay-out of the printed page. In other words, colour can be used to differentiate one column from another, one subject from another, one category of information on the screen from another, thus tightening and improving the presentation. Colour changes should never be arbitrary, but should themselves convey a meaning.

Apart from indexing, already discussed, pricing is the other peculiarity of Prestel. Each small page has its own fee for looking at it, in addition to the telephone and computer access charges. With a newspaper, you pay one single sum for the whole lot; the same with a book. The BBC has a single licence

fee per annum. But with Prestel, each separate nugget or page can have a price fixed individually by the editor, ranging theoretically from 0 pence to 50 pence, in practice from 0.5p to 25p depending mainly whether the page is meant for domestic or business use. So the pages have to be worth it. Not only should the indices not mislead, misroute or mislay; but the pages of actual information should be up-to-date, to-the-point, value-for-money. Pricing becomes part of the editing process.

Turning the pages of Prestel, you will therefore find five different sorts of page. You will find pages to read, that is, text; pages of statistics, like share prices from the Stock Exchange or racing results from Extel; graphics, that is, pretty designs to make the thing look more attractive; index pages, those with the numbers 0 to 9; and directory pages, those with lists of addresses, names, holidays, hotels, spare parts, consumer durables, cars to buy, mainly derived from lists that already exist elsewhere.

The bulk of the pages now on Prestel are of this directory type. Some argue that the small page size means that this is inevitable, and that Prestel will be like a gigantic reference book for people looking for very specific bits of succint information across a huge range of topics. Others argue that unless Prestel can be developed as an original publishing medium for comment, debate and argument, on social, political, financial or leisure topics, then it will never make its mark.

Several IPs have made a deliberate attempt to explore the possibilities of authors writing original material for Prestel. The text has to be written, or at least edited, into the special and highly constricted format of Prestel. One cannot let text spill over from one page to the next in random fashion; there is no way that anyone is going to read War and Peace on Prestel. The pages are too small, and the screen has too much glare to read a lot of pages in a concentrated manner.

On the other hand, painting produced the miniature as well as the panoramic canvas; literature produced the eleven-syllable Japanese poem, the Haiku, as well as War and Peace. Not that there

is any poetry yet on Prestel, though I see no reason why not (there is a do-it-yourself rhyming verse game in poor taste). But there are points of view on almost anything that do not need a million pages to propagate.

As to graphics pages, the fact that Prestel offers colour graphics at all is of course itself a distinct feature of the system. But it must be recognised that Prestel graphics are, at the present stage of technical development, very crude in design terms, being made up of comparatively few building blocks of colour in relation to the total screen. Unless and until they are refined to the point of being able to show, say, accurate road routes for motorists, the graphics will be mainly decoration - and people will not for long go on paying real money for decoration. Graphics will have a limited use for some years to come - limited perhaps to title pages of individual databases, advertising applications and games. Other viewdata systems of different design, and Prestel in the future, may have quite different graphic capabilities.

With different sources, different lay-outs, different colours, different purposes, it is not surprising that the Prestel pages speak to the reader in different ways. The directory pages, those with lists, have the simple objective of providing facts, dates, numbers, prices. Other pages talk to you in a very conversational way, almost as if having a chat with you; this style is rather like a page in a tabloid newspaper.

Thirdly, there are advertising pages. We still do not know how much advertising there will be on Prestel, and quite what it will look like. Fourthly, there are computers talking to computers. Some IPs have their information on computer anyway, and simply (except that it is not all that simply) do a periodic machine-to-machine transfer. Whether the resulting Prestel pages are good or bad is perhaps a matter of taste. Some of the worst organised material to have appeared on Prestel, as well as some of the best, has been fed in computer-to-computer. On the other hand, in the long run it may be the cheapest and most efficient way to supply Prestel.

For all these reasons, the relationship between the publisher on Prestel and the reader/user is a novel and delicate one. When you tune in to Prestel and start pressing the numbers on your keypad, the IP may be speaking to you in several different ways. He may be saying, in effect "I offer you either A or B or C to look at". That is the simplest version of the choices offered by the indexes. Or he may be saying "I offer you A and B and C", where he is inviting you to build up a cumulative picture of, say, a holiday in America or a British company.

Or he may be saying "I suggest you try A, then to to B, then go to C", where the IP is deliberately taking the initiative and guiding you by the hand round his "information stall". But equally, he may offer you a random collection of items for you to make your own sense of, in the form "A+L+P+B+Z". Or he may have a subtle approach, saying "Read A: if you need more detail, read B; if you need even more detail read C", so that different degrees interest are satisfied in different ways.

For all these reasons, editing for Prestel is not like newspaper editing, and not like computer programming, but a novel and challenging mixture of disciplines drawn from both.

CCETT

CENTRE COMMUN D'ETUDES DE TELEVISION
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NOTE TECHNIQUE

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# PRESENTATION DE STAR

(Source Teletel Accès Réseau)

## I - Généralité

STAR est un produit orienté vers la distribution d'informations vidéotex. Il se compose d'un matériel, minicalculateur standard du marché (Solar) et d'un logiciel entièrement spécifique (développé au CCETT).

STAR a été spécifié et réalisé dans le cadre d'un projet d'étude nommé "réseau de sources de vidéotex". Il s'agissait d'étudier un système global permettant d'assurer l'ensemble des fonctions nécessaires à la gestion d'un réseau public vidéotex (voir annexe 1).

Dans cet esprit STAR est au minimum dépendant de deux autres types d'équipements :
- les "concentrateurs" qui gèrent les terminaux vidéotex,
- l'éditeur/composeur qui permet la création et mises à jour des services distribués par STAR.

Tous les équipements communiquent entre eux par l'intermédiaire du réseau TRANSPAC

## II - Les objectifs de STAR

### a) fiabilité

Doit fonctionner sans interruption 24 heures sur 24 et 7 jours sur 7.

b) performances

. importante base de donnée supérieure à un million d'écrans
. nombre de consultations simultanées : plusieurs centaines d'abonnés.

c) Procédure d'accès simple à l'information pour l'abonné

L'abonné doit pouvoir, s'il le désire :

. accéder directement à l'information,
. s'"exprimer" dans un langage quasi-naturel (pas de codes systématiques).

d) Gestion d'une grande variété de services

. consultation : l'organisation du service n'est pas imposée au prestataire, il doit pouvoir définir librement sa structure (arborescente, maillée, matricielle, associative...)

. transaction : on doit pouvoir gérer des transactions simples.

On couvre ainsi les domaines d'utilisation grand public et professionnels.

## III - Les solutions retenues pour STAR

### A) Fiabilité

La solution "classique" consiste à proposer des systèmes doublés, très onéreux en développement de logiciels et coût des matériels. Ayant une optique réseau nous pouvons proposer si besoin est, une duplication des services dans des équipements indépendants. Ainsi, si l'un d'eux est défaillant, il est possible de mettre dans le concentrateur des dispositifs plus ou moins intelligents pour reprendre la session avec un autre équipement et celà de manière transparente à l'utilisateur.

Par ailleurs, les logiciels de STAR ont été conçus pour supporter la défaillance de certains éléments matériels (ex : processeurs), avec pour seule conséquence une diminution des performances.

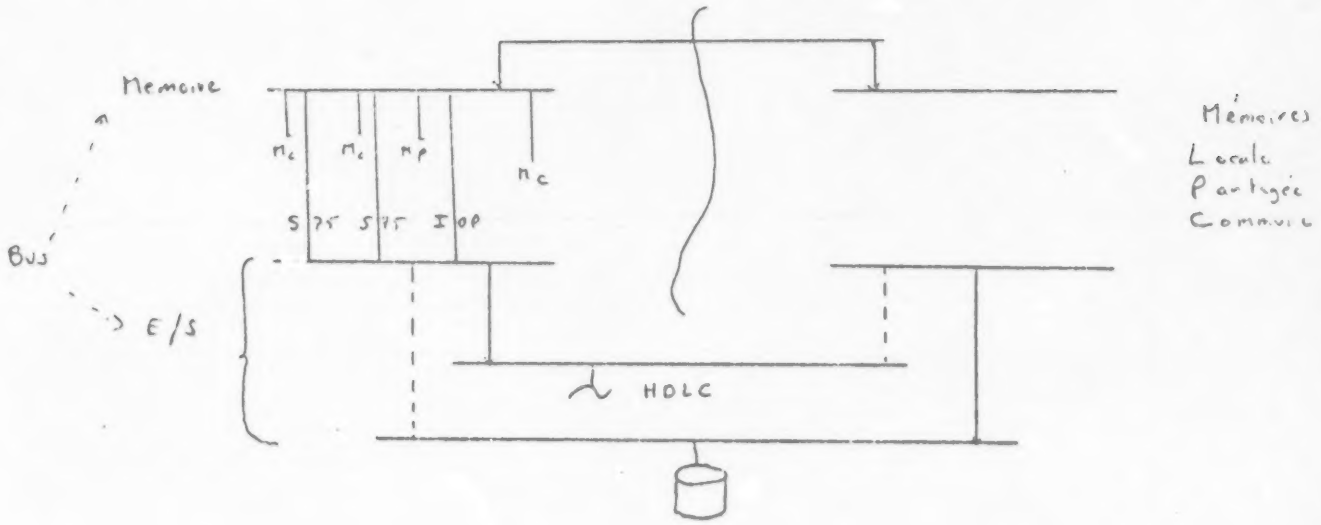
### B) Performances

#### B-1. Choix de configuration matérielle

Tout en restant dans une gamme de produit standard, les logiciels STAR sont capables de supporter :

- des configurations multiprocesseurs : un à trois processeurs de traitement (S40 et/ou S65 et/ou S75).
  (système polybus) → multiminiordinateur, deux minis peuvent être couplés max. 6 processeurs S75.
- des lignes HDLC à haut débit (150 Kbits/s) donc des raccordements à TRC à 48 Kbits/s.
- des disques grosses capacités (jusqu'à 8 disques de 300 mega-octets chacun).

exemple : Polybus




| Configurations | minimale | maximale |
|---|---|---|
| processeur traitement | 1 (S40) | 5 (S40 ou S65 ou S75) |
| processeur IOP | 1 | 1 |
| mémoire en Kmots | 32 | 2048 (500 suffisent) |
| disques 10 MØ | 1 | 16 |
| disques 300 MØ | | 16 |
| accès réseau (HDLC) | 1 | 6 |
| nombre d'usagers simultanés | 50 | 600 |
| coût approximatif HT | 200 KF | 1,3 MF (avec 4 disques 300 MØ) |

B-2. Développement de logiciels spécifiques

Pour atteindre les performances visées il n'était pas envisageable d'utiliser les logiciels standards proposés par le constructeur, leur aspect universel ne leur permettant pas d'être efficace dans notre cas d'utilisation.

Nous sommes donc parti d'une machine "nue" et avons développé l'ensemble des logiciels. Ils comprennent les logiciels de base (système opératoire, accès réseau) et les logiciels d'applications (distribution, mise à jour).

Les logiciels de base

L'objectif étant de fournir un environnement (pour le développement des applications) qui soit très performant dans la gestion des fonctions temps réel et dans le gestion des usagers.

α) système opératoire OREGON

(ORdonnateur Et Gestionnaire de prOcessus pour N processeurs).

Il permet :

- aux applications de se dérouler dans un contexte multiprocesseur, voire multiminiordinateur tout en gardant une organisation simple (1).
- de banaliser le rôle de chaque processeur (pas de maitre, donc bonne fiabilité)
- de gérer des coupleurs HDLC à des cadences très élevées (150 Kbits/s)
- de gérer des disques de grosses capacités en minimisant les déplacements de bras (file d'attente type ascenseur).

β) accès réseau X25

Le logiciel développé permet de se raccorder à un réseau (type TRANSPAC ou équivalent), mais aussi de raccorder directement à la machine des ETTD (exemple : concentrateur ou éditeur). Le logiciel supporte simultanément un ou plusieurs raccordements des deux types.

Vu de l'application, le logiciel présente, pour la transmission des données, une interface de type message par abonné (réel ou virtuel), ce qui simplifie énormément le codage de l'application.

Il est à noter que le logiciel est très performant, il permet notamment d'expédier vers le réseau une information en provenance du disque sans aucune recopie intermédiaire en mémoire.

Un programme de test a été écrit pour valider OREGON - X25. Réparti sur deux configurations mono-processeurs (16-40), raccordées en X25, il a permis de gérer efficacement une ligne 48 Kbits/s (30 Kbits/s efficace) en simulant pour un seul disque 50 accès simultanés.

Le développement des logiciels de base que nous venons de décrire succinctement a pu être codé en un peu moins de 12 Kmots de mémoire.

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(1) Une application est composée de processus. Un processus réalise une fonction pour un ensemble d'usagers. Un usager est identifié par un contexte qui "voyage" d'une file de processus à l'autre en fonction des événements échus; ce mécanisme est décrit et géré à l'aide d'une table de décision attachée à l'application.

C) Accès à l'information

C-1. Les commandes de l'useger

Sélection

La base de données distribuée par STAR est composée de "multi-écrans" * qui seuls peuvent être sélectionnés directement. Un multi-écran (ME) est physiquement composé de n écrans (n quelconque) et représente une entité logique.

Suivant les cas, le choix d'un ME peut résulter d'une commande :

- numérique $\in [1, 10^{12}]$
- alphanumérique : il s'agit alors de mots clés associés au ME.

De plus, un ME peut être accédé directement, soit en fournissant son identification numérique, soit par une combinaison de mots clés (ex : le PIB de la FRANCE).

Les touches fonction

α) information logique suivante/précédente

Ces touches permettent de consulter les écrans du ME soit en "marche avant", soit en "marche arrière". Elles permettent aussi d'accéder à d'autres ME de la base représentant une suite logique ou un retour logique. Les chemins logiques suivis dans la base sont, soit prédéterminés (par le prestataire d'information), soit dépendant d'actions antécédentes de l'useger.

β) répétition

A pour fonction la retransmission de l'écran courant. Peut être utilisé soit en cas d'erreur de transmission, soit pour consulter une information mise à jour en temps réel.

γ) début

Permet à m'importe quel niveau de la consultation de revenir au sommaire des services disponibles.

δ) gomme caractère

Permet une correcti n des commandes frappées. Actuellement cette touche est gérée par le terminal ainsi que l'écho (en rangée 0) des caractères frappés, STAR faisant un "écho message" de la commande tapée (réimpression avec changement de couleur).

En conclusion, on voit que le petit nombre de touches fonction, la possibilité de s'exprimer dans un langage quasi naturel rendent très simple la consultation des services STAR.

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* Dans une terminologie en cours de normalisation : le ME = le document, l'écran = la feuillet.

## C-2. Organisation "physique" de la base de données

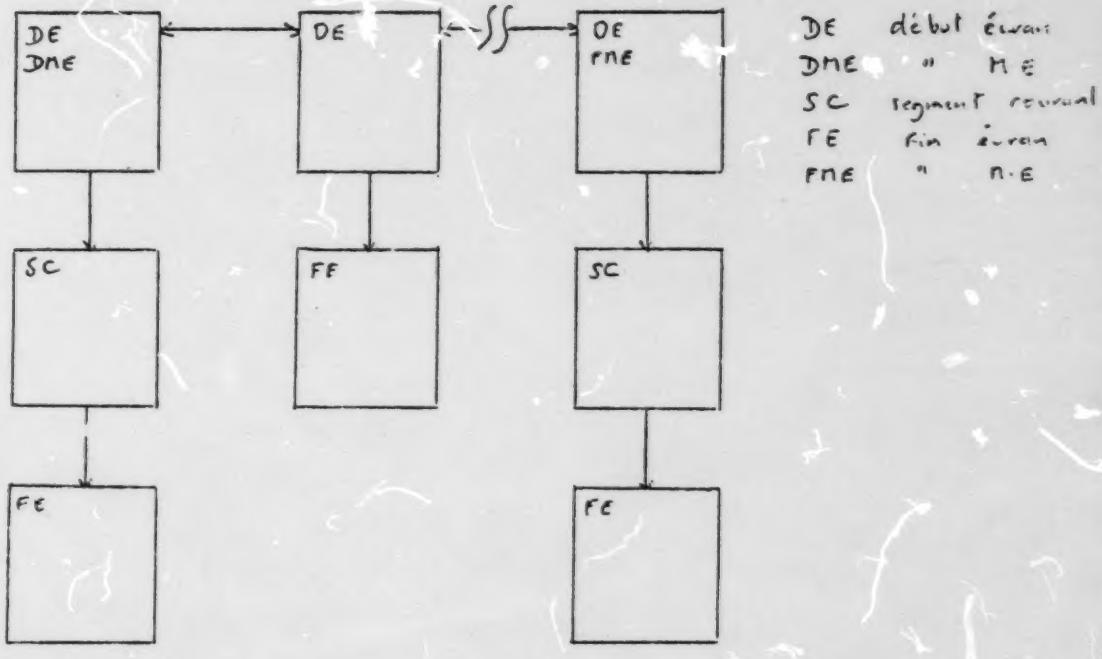
### 1- identification et accès au ME

Dans la base tous les ME sont identifiés par une adresse dite symbolique $\in [0,10^{12}]$, elle peut être fournie par l'usager en cas d'adressage numérique. Cet adressage peut, si le prestataire l'a décidé refléter un embryon de structure logique entre ME (type arborescent). Les ME sont évidemment stockés sur disque ayant une structure d'adressage de type secteurs (=n mots). Pour passer de l'adressage symbolique à l'adressage secteur, on utilise une formule de compression (hash-code) qui permet d'accéder directement au ME (pas de chainage). Pour ne pas être dépendant des caractéristiques physiques des disques et pouvoir plutôt s'adapter aux contraintes physiques des écrans, on a défini une notion logique dite de segments, la taille des segments en secteurs est fixée à la génération du système.

ad symbolique $[0,10^{12}]$ —hash-code→ ad segment $[0,2^{24}]$ → AD PHYSIQUE (N° disque, n° cylindre-piste-secteur).

### 2- structure des ME

Le schéma suivant représente sous forme de segments la structure des ME

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Cette structure permet :

- de ne pas limiter le nombre d'écrans d'un ME (minimum 1),
- de ne pas limiter la taille d'un écran (minimum utile réservé 32 octets),
- de ne garder en mémoire par usager et durant la phase de transmission qu'un segment. Il s'agit d'un point fondamental, en effet gérant des centaines d'usagers, il n'était pas envisageable de conserver pour chaque usager tout un écran en mémoire.

En distribution, la mémoire (segment) est réservée dynamiquement quand le bras du disque est bien positionné, et libérée dès que la transmission vers le réseau est finie.

D) Les services gérables par STAR

L'objectif était de gérer de nombreux services autour de la fonction de distribution :

- consultation de la base,
- service dit d'exécution,
- transactions - jeux,
- boite aux lettres électronique,
- ...

Les réalisations actuelles concernent uniquement la fonction de consultation, mais les logiciels ont été conçus pour évoluer vers les autres fonctions.

D-1. Organisation logique de la base de données

Les premières réalisations (antérieures à STAR) sur les consultations de base de données vidéotex ont fait apparaître de graves insuffisances :

. structure unique et statique de la base (arborescence),
. distribution non personnalisée des informations.

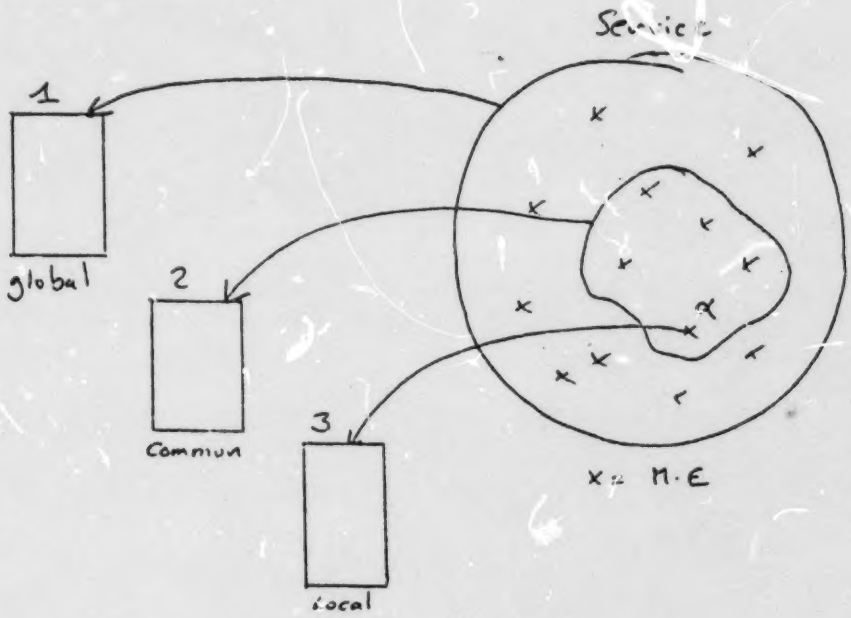
Nous avons donc étudié un système permettant toute liberté dans ces domaines.

L'idée maitresse a été d'affecter à chaque ME à distribuer un programme de distribution entièrement spécifié par le prestataire de service. Ce programme permet de définir une structure entièrement libre de consultation des ME qui de plus peut être dynamique, c'est à dire dépendant de l'usager ou plus exactement de ses actions antérieures. Le programme est écrit dans un langage de haut niveau accessible à des non informaticiens.

Le principe du programme de distribution permet d'envisager une très grande variété de structure : linéaire, arborescente, maillée, matricielle, associative... ou tout autre.

Des directives du langage permettent de définir des mots-clés associés au ME, le nombre de mots-clé et leur taille (en caractère) n'est pas limité pour un ME donné. La portée des mots-clé est définie par des dictionnaires, à chaque ME sont affectés jusqu'à trois dictionnaires qui sont consultés jusqu'à concordance avec le mot-clé frappé par l'abonné. Des dispositifs (joker troncation ...) sont prévus pour pallier dans une certaine mesure aux fautes [illegible] de l'abonné.

Exemple de dictionnaires :




Ici, les mots-clés du dictionnaire 1 seront reconnus à tout moment (ex : SOMMAIRE, SOS, DEBUT...), ceux du dictionnaire 2 ne sont reconnus que dans un sous-ensemble de ME, ceux du dictionnaire 3 sont spécifiques au M E $\alpha$ .

STAR peut consulter plusieurs dictionnaires en cascade (sans visualiser les ME intermédiaires) et gérer ainsi un accès direct alphabétique à l'information.

Exemple : service géo-économique sur l'Europe.
l'usager peut passer des commandes du types

LA SANTE DES FRANCAIS↵

CELLE DES ALLEMANDS ↵

LA CARTE DE L'ITALIE↵

LES EXPORTATIONS↵

etc...

à chaque commande l'usager reçoit l'information sous forme d'un (voire plusieurs) écran(s).

Le langage de programmation comporte actuellement une quinzaine d'instructions, ses spécifications fines ainsi que les possibilités qu'il offre sont décrites dans le document "Langage de programmation des bases de données STAR" RSI/41/443/79.

Ce langage est en cours d'enrichissement de quelques instructions de calcul et de composition dynamique d'écrans, ainsi STAR pourra gérer des transactions, des jeux, des services d'exécution.

D-2. La mise à jour temps réel de STAR

Un protocole de mise à jour de la base de donnée a été spécifié et réalisé. Il permet de modifier (ou créer) simultanément plusieurs services de manière indépendante, les informations de mise à jour provenant d'un éditeur et/ou de petites sources de composition.

Les mouvements de mise à jour opèrent au niveau du ME et permettent d'en modifier (1) indépendamment tous les composants: programme de distribution, dictionnaires, écran et même des portions d'écrans.

Suivant la nature de la mise à jour, le service continue ou non d'être distribué aux abonnés. Un blocage de la distribution est obligatoire et effectué de manière autoritaire (2) durant le temps de restructuration du service; par contre la modification de données (écran, zones d'écran) est transparente (3) aux abonnés consultant le service. La décision de blocage ou non du service est communiquée à STAR durant la session de mise à jour, cette décision émane soit de l'éditeur, soit du prestataire de service (indirectement).

Le protocole est actuellement mis en oeuvre en utilisant une bande magnétique comme support physique de transmission, sous peu seront finalisés les logiciels utilisant des disquettes et X25 (réseau TPC).

D-3. L'éditeur

L'éditeur est la partie visible du système STAR pour les prestataires de service. Son rôle consiste à gérer simultanément plusieurs prestataires en résolvant ces problèmes généraux de contrôle d'accès, allocation et partage des ressources, cohérence des services et de la base, sauvegarde-sécurité... De plus, il doit aider chaque prestataire dans :

- la composition des écrans,
- l'écriture des programmes de distribution et la définition des mots-clé,
- la mise à jour immédiate ou différée (à une heure prédéfinie) du service.

A ce niveau, le travail important consiste à réaliser un compilateur des instructions du langage de distribution. Outre les fonctions de base de compilation, il offrira au prestataire un environnement lui permettant de simplifier les tâches d'édition on peut envisager :

- un système de macro-instructions ou programme paramétrés,
- un générateur automatique de programme décrivant les structures les plus usuelles (arborescence, matricielle, associative...).

L'ensemble de ces fonctions sont en cours de développement sur SOLAR autour des logiciels de base OREGON-X25.

Nous avons dû mettre en oeuvre un minimum de ces fonctions pour que STAR puisse être exploité. Pour ce faire, une chaine de production simplifiée de magazine ou service a été réalisée sur IRIS 80. Elle permet de récupérer sur bande magnétique l'ensemble des informations nécessaires à la création du service (conformément au protocole défini).

---

(1) par modification, on entend création ou suppression ou remplacement.
(2) les abonnés consultant le service sont avertis et invités à choisir éventuellement un autre service.
(3) il pourra se produire des cas rarissimes de conflit d'accès à l'information, dans ce cas, un message est envoyé à l'abonné l'invitant à demander une répétition.

IV - La situation de STAR

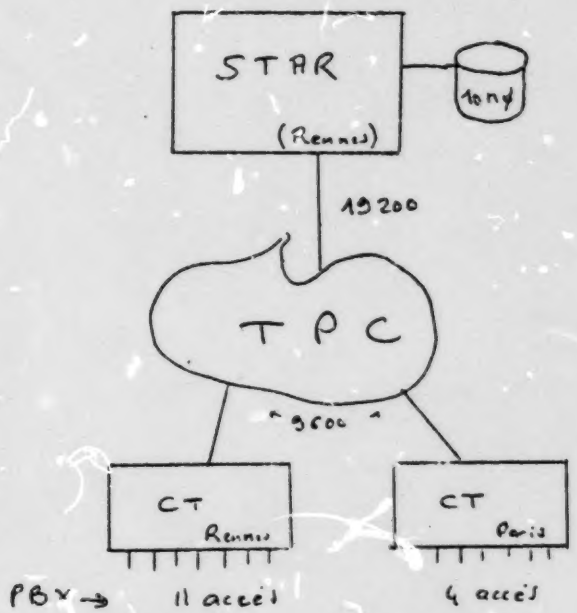
A- Hier : septembre 1979

A cette date, une première version du système a été mise en exploitation. Au niveau logiciel, les fonctions suivantes étaient disponibles :

- OREGON,
- X25,
- distribution,
- mise à jour "off-line" de la base.

L'ensemble de ces fonctions sont codées sur un peu moins de 15 Kmots de mémoire. L'investissement de conception-analyse programmation se chiffre à environ 7 années-hommes (y compris la chaine de production IRIS 80).

. La configuration du mini-réseau en exploitation est la suivante ;




SOLAR 16-65 - 64 Kmots
disque 10 MØ
26 CV

. Les services distribués concernent :

- des informations sur les pays arabes,
- base de données géo-économique européenne,
- information sur le videotex-STAR...

. La fiabilité de STAR est excellente (voir note info-STAR); ses performances et qualité de service sont à la hauteur des objectifs.

B- Aujourd'hui

Sur des configuration de laboratoire de nouveaux logiciels sont opérationnels :

- mise à jour de la base sur temps réel sur support bande magnétique et X25,

- gestion de disques 300 méga-octets, ce qui permet d'envisager des bases de données de plusieurs centaines de milliers d'écrans.

Au niveau des services, plusieurs réalisations sont en cours :

- aides publiques à la création d'entreprise,
- les télécommunicarions : l'entreprise et ses produits,
- nomenclature des matériels des télécommunications gérés par la DAAT à Bordeaux,
- statistiques de fonctionnement des autocommutateurs de la région Bretagne (DRT)
- service de téléécriture.

Par ailleurs, le CCETT et le CAP-SOGETI sont en train de signer un accord de concession sous licence de STAR. Deux autres SSCI sont intéressés par de type de contrat (TELESYSTEME et GIRATEV).

C- Demain

De nombreux développements logiciels sont en cours autour de STAR.

1) éditeur :

Tel qu'il a été décrit précédemment, il devrait être réalisé pour la fin du second semestre 80.

2) Boite à lettres électronique

Réalisée fin juin 80.

3) Transactions :

Le logiciel permettant de supporter des transactions réelles sera disponible fin novembre 80.

4) Annuaire électronique :

Le fichier des abonnés d'Ille et Vilaine sera chargé sur STAR; on aura accès aux abonnés résidentiels (alphabétiques), professionnels (par spécialités et marques), ainsi qu'un accès par numéro téléphonique. Une première version des logiciels sera disponible fin juin 80. Elle servira à l'expérience de Saint-Malo qui concernera 50 terminaux mis à la disposition du public (juillet-août 80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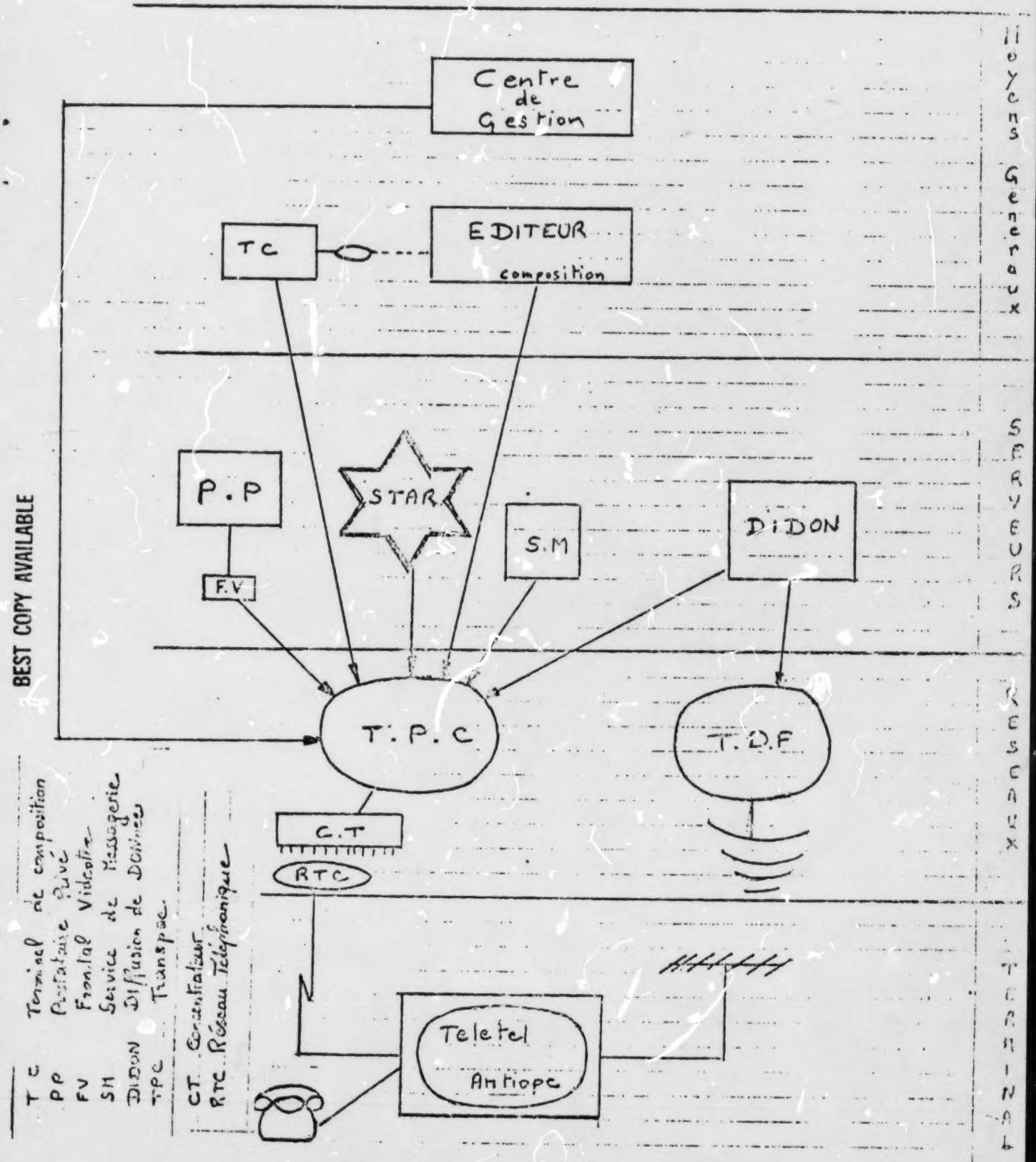
# Architecture du "Réseau de Sources Videotex 87"

ANNEXE 1

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ANNEXE 2

Principales notes techniques sur STAR

| | | |
|---|---|---|
| RSI/T/21/78 | | OREGON |
| RSI/23/203/78 | ∂ | RSI/23/202/78 compléments OREGON |
| RSI/23/98/79 | | les contextes applications |
| RSI/23/102/79 | | les contextes usagers |
| RSI/16/133/79 | | primitives d'OREGON |
| RSI/23/168/79 | | X25 niveau paquet |
| RSI/41/145/79 | | le processeur de la machine virtuelle de distribution |
| RSI/41/144/79 | | l'unité d'entrée/sortie dela machine virutelle |
| RSI/41/146/79 | | l'opérating système de la machine virtuelle |
| RSI/41/443/79 | | langage de programmation des bases de données STAR |
| RSI/42/430/79 | | protocole de mise à jour de la base STAR |
| RSI/23/293/79 | | les commandes utilisateur de STAR |
| RSI/23/301/79 | | procédure d'accès à STAR. |

# Preliminary views on data base architectures for videotex

Frank Wm. Tompa
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(June 1980)

Before considering alternative data base architectures and related problems such as network design and control, it is important to identify the criteria by which videotex systems will be judged. After such identification, technical questions, including file structure design, the alternative modes of distribution, and the role of commercial data base management systems, can be weighed in perspective.

The primary criterion for acceptability is convenience to the user. If videotex systems are to be acceptable in the home or in business, they must be user-friendly and avoid seemingly unnecessary actions from the users.

Closely related to this criterion are the needs for reliability and responsiveness. If the information stored in a videotex-based data base is not available on demand or not available in (the expected) short time, the system will not be successful. For example, one feature of videotex systems is the ability to provide up-to-the-minute stock information; if the hardware, software, or communications systems fail or if the response time is excessively delayed, customers will revert to the use of telephones and written materials.

Because the videotex technology is so new, the requirement for flexibility is essential. Few businesses or individuals know now how they will use videotex systems to their advantage, and therefore there is very little about videotex that can be assumed to be constant. Certainly the type of information to be stored and the patterns of usage are unknown now, but the hardware support (from processors and storage devices to communication equipment and home receivers) are also subject to change. A successful data base design must therefore be adaptable to all changes in its environment.

Finally there are several factors that affect users only indirectly, through financial cost. Data base architectures must be designed with consideration for size (both primary and secondary memory requirements), hardware requirements, software development and maintenance costs, and data base provider costs (those aspects which cause data suppliers to pass on increased charges to their customers).

Because videotex systems must be designed for non-technical users, the user view should be the first aspect to be designed. Current systems all rely on the use of a hierarchical directory, each level of which has a maximum branching factor of approximately 10. Although hierarchies are extremely common in non-computerized systems (and thus familiar vehicles for naive users), most have much larger branching factors (30-100) and therefore require less depth to hold equivalent amounts of information.

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A major problem with hierarchies is that they are not unique nor, in any sense, universal. Therefore, in spite of all efforts to provide quick response to page requests, users will encounter long delays when retrieving information, as a result of traversing many levels often following false paths. Providing the ability to access pages by absolute page address relieves the problem only slightly; users must still probe the hierarchy to find new information, and they must now keep an external (paper) notebook of commonly used page numbers.

Before accepting hierarchies as the only standard structure, it is worthwhile to consider other structures commonly used to access information. These include alphanumeric listings (dictionaries, parts lists), chronological listings (newpaper files, almanac entries), and keyword retrieval (using predefined, registered terms only or free choice keywords). The alternatives should not be disregarded out of hand, but rather their usefulness should be appraised and technical solutions (such as higher communication band width or local memories with a "scrolling" option) should be sought where needed.

A final note on directory structures is that they need not be unique to the system nor universal to all its users. For example, if hierarchies are chosen, certainly several hierarchical structures could be superimposed over a set of data or the hierarchies could be merged to form a less restricted graph structure. Such a system, especially if structured under user control, would eliminate many of the drawbacks mentioned above while still preserving the simplistic hierarchical view for users who wish it.

The last topic for this note is that of data base scope, that is consideration of data availability within the local/universal spectrum. It if obvious to most that some data is oriented to individuals whereas other data has national or universal interest. It is imperative that an interactive videotex system provides facilities for both types of data. The result is a need for individual user update capabilities, either through rental of centrally managed storage or (more likely) through local storage facilities. Furthermore, there is not merely a dichotomy, but rather at least two spectra of scopes: geographic (individual/neighbourhood/city/province/national) and interest-based (individual/department/enterprise/business sector/ universal). This has great implications for decisions regarding local copies with automatic updating vs central storage with user-oriented address mappings, and emphasizes the need to consider many possibilities for data distribution and network architectures.

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